THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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BROADCAST TELEPHONY.

THE subject of "broadcasting" has been brought into marked prominence of late in the lay Press, owing to the development of a "raging, tearing, propaganda" directed to the abolition of the system which has been in existence for but a few months, and the substitution of a freedom which, we fear, would be indistinguishable from chaos—the very thing which the Postmaster-General and the original radio manufacturers were most anxious to avoid. The opponents of the existing system appear to comprise, in addition to certain newspapers, a large body of manufacturers who have not joined the British Broadcasting Co., Ltd., the Electrical Importers' and Traders' Association, the British Radio Manufacturers' and Traders' Association, the Radio Society of Great Britain, and doubtless a large proportion of the 200,000 "listeners-in" who are said to have equipped themselves with home-made apparatus but to be unable to obtain licences of any kind.

That steps must be taken to cope with the situation in view of so widely extended an agitation is obvious, and it is reported that Sir William Joynson-Hicks is giving the matter close attention with a view to arriving at a satisfactory solution of the problem. The issue of a third type of licence, as we recently pointed out, would meet the case of the listeners who are ineligible for either of the existing licences; their case will certainly have to be met, and if the majority of them contributed 10s. or 20s. a year to the revenue, the income from this source would go far to make good the deficit which under present conditions seems likely to confront the shareholders of the B.B.C. at the year's end. But the opposition goes much further than that; it attacks the monopoly of broadcasting which has been conferred on the B.B.C., and the monopoly of manufacturing which is alleged to have been granted but which does not in fact exist.

That the system so far has not had the desired result, the B.B.C. itself admits; the revenue on the present basis falls far short of that necessary to meet expenses, let alone the increased expenditure needed to bring the standard of the broadcast programmes up to the degree of excellence which is aimed at. Whilst the dominating partners in the company are, no doubt, some six big concerns, it should be borne in mind that 23 firms took part in the preliminary negotiations with the Postmaster-General a year ago, 300 were represented at the conference in October, the total membership of the B.B.C. to-day includes more than 480 companies, and in all 600 have applied for admission, which they can easily obtain; if, therefore, the B.B.C. is accused of holding a "monopoly" of manufacturing, we must seek a new definition of the term. Of the many firms alleged to be aggrieved, the greater proportion are newcomers to the radio trade and have borne no part of the heavy initial expenditure which has been incurred by the B.B.C.

It should not be forgotten that we are dealing with an entirely new set of circumstances, for which no precedent exists. The ether which is the medium through which the Hertzian waves are propagated pervades all space and is common to all users, and vibrations impressed upon it are generally disseminated in all directions, without control or guidance; the only characteristic by which the radiation from one source can be differentiated from that of another is its frequency or wave-length, and for sound and good reasons there is only a limited range of wave-lengths that can be placed at the disposal of the broadcasting stations.

The greater the number of these, the less the difference between their characteristic frequencies, and the greater the difficulty of preventing interference between them at the receiving instruments. What, then, is the consequence of permitting the free use of the ether to all who choose to set it in vibration?

For the answer we turn to the United States, where unrestricted broadcasting has been practised for more than a year. As a result of this system of "freedom," last month a conference was called by Mr. Hoover, the Secretary of Commerce, "to consider the chaotic condition in which radio transmission has been left by the failure of Congress to take action" (we quote from the *Electrical World* of March 24th). Mr. Hoover stated that since a conference held a year ago the number of broadcasting stations had increased from 60 to 588, and the number of receiving stations had more than doubled, being now between 1½ and 2½ millions. "He called for organised co-operation to meet the emergency." Dr. A. N. Goldsmith, secretary of the Institute of Radio Engineers, said he thought that economic reasons would cause the discontinuance of high-class broadcasting unless it could be protected.

The report of the Radio Corporation of America, which shows an enormous increase in gross receipts for the past year due to the demand for radio sets (mainly offset by a corresponding increase in expenses, preventing the payment of any dividend), indicates that while broadcasting "has become a permanent part of the everyday life of the people," interference has been so troublesome that it is clear that broadcasting must eventually be organised on a national basis. "The questions of who eventually is to do broadcasting, or of how it is to be paid for, and of how to utilise the available wave-lengths so that the greatest good will come to the greatest number, must be answered before broadcasting can be put upon an enduring and satisfactory basis."

It was to avoid the development of such a situation that the British Broadcasting Company was formed, with the cordial assistance of the Postmaster-General; and so far as the prevention of interference is concerned, the scheme has been entirely successful—there is no "radio chaos" in this country. Only by the co-ordination of broadcasting can that condition be avoided, and consequently it is imperatively necessary that the establishment of transmitting stations shall be kept under strict control. Moreover, it is obviously essential that those who undertake broadcasting shall be adequately remunerated for their outlay and service. In securing this result the interests of the general public will be protected, for the "listener-in" will be guarded against the discordant efforts of rival transmitting stations, and the broadcasting authorities will be enabled to provide programmes of unexceptionable excellence. It was believed that these conditions would be attained by the adoption of the existing system, but it is clear that it fails in one essential—the provision of an adequate income. Moreover, the licensing scheme has failed to take account of a class of user which has unexpectedly proved to be numerically by far the largest, and, as will be gathered from the memorandum addressed to the Postmaster-General by the Radio Society of Great Britain, which has just reached our hands and is printed elsewhere in this issue, the broadcasting scheme has crippled the work of the *bona-fide* experimenter, which must be admitted to be of the greatest value to the nation.

It will be observed that the Radio Society supports the proposal which we put forward in a recent issue—namely, that a third form of licence costing 20s. should be issued, permitting the use of any apparatus whatever for listening-in.

On the other hand, the Electrical Importers' and Traders' Association, and the British Radio Manufacturers' and Traders' Association, propose the issue of a single 20s. licence for all users, and trading licences of £10 for manufacturers and £2 for dealers in radio apparatus in lieu of the system of trading royalties. These are matters worthy of discussion, but at the moment the really urgent question is the issue of the third form of licence, which would probably solve the present difficulties; afterwards the whole scheme—which in any event would come under revision at the end of next year—could be critically examined with a view to the adoption of a sounder basis, free from the objections which have been so widely voiced.

Electricity Supply in 1922.

The electricity supply industry has been spoken of as "the barometer of trade," but, like the domestic barometer, it does not always fulfil its allotted function. In 1922, although industry in general had not emerged from that Slough of Despond into which it was cast by the reaction from the "boom" years which followed the war, the electricity supply industry took a great forward step. Practically without exception, the companies' reports, which we have reviewed from week to week, have shown increased output and greater profits.

The increased output shows that electricity has further consolidated its position as an essential factor in modern life; too long had it been regarded as something to take up when things improved and the outlay was "justified." It is now recognised that electricity is a most potent factor in improvement—we might almost say it *is* improvement—and thus its development must continue. The fact that, although industry has been depressed, the sales of energy have risen, indicates the awakening of the domestic consumer. It is encouraging to hear of the 12,000-kilowatt heating and cooking load connected to the Newcastle-on-Tyne Electricity Supply Co.'s system; this is an example of development which should stimulate enterprise in this direction, and induce other suppliers to prepare for the load of the future.

This increased output has been attended by remarkable reductions in working costs. How far this has been due to the steady fall of prices, and how far to improved methods and machinery and to better fuel is not easily decided. The fact remains, however, that the efficiency of generation has improved to a very marked degree in many cases. For instance, the Notting Hill Company recorded that the fuel consumption per kilowatt-hour generated had fallen from 4 lb. in 1919 to 2¼ lb. in 1922. Again, the Charing Cross Company generated an extra eight million kilowatt-hours, but the coal consumption fell by 12,000 tons. To a smaller extent, the coal consumption of the St. James' and Pall Mall Company decreased by 4,000 tons for an increase of 7½ million kilowatt-hours. These are London companies, and although maybe the results are slightly better than those obtained by provincial undertakings, the latter are by no means backward, taking them as a whole. In one or two centres, such as the Clyde Valley, industrial slackness has retarded growth, but we have not yet seen a single case of a reduction in output.

The progress recorded is not merely a "boom," it is the steady natural advance which is the destiny of the electricity supply industry. That it is being continued is apparent from the reports of undertakers for the first three months of the current year; everywhere improvement is recorded. So much for the companies. Whether the experience of the municipalities has been of the same encouraging character is not yet known to any great extent. The working year has only just closed, and information is very scanty, but already we hear of large contributions to rate relief from the electricity undertakings, *e.g.*, St. Pancras has allocated £25,000 to this purpose. This is an indication of financial success, but whether it is sound practice or is equitable to the consumers is another matter.

Satisfaction must be expressed at the reduction of prices which is taking place everywhere. We sincerely hope that they will continue to fall, for only by low prices can electricity be brought within the reach of the large masses of the people who represent the

domestic load. We are not without hope that one day a universal rate of ½d. per kilowatt-hour will be a commonplace.

On the other side of the Atlantic progress has been amazing. The Water Power Branch of the Canadian Department of the Interior states that the electrical load of the Dominion is being doubled every seven years. Some particulars of recent developments are given on another page of this issue by our Canadian correspondent.

Mr. Creed, President of the Pacific Gas and Electric Co., San Francisco, recently said that the capital of electricity supply companies operating in the United States had increased by 12 per cent. during 1922, reaching a total of $5,100,000,000. The gross revenue for 1922, £1,058,000,000, was double that of five years ago. The same rapid growth has been experienced on the European Continent, and further afield, which all goes to show that we in this country still have a long way to go. Our circumstances may not be so favourable as those of other countries, but there is an enormous field still lying fallow from which a profitable crop is to be obtained by the planters of the "electrical idea."

Electricity for Farmers.

Compared with many lands, little has been done in Great Britain towards the application of electricity on the farm. France and Belgium are two countries where considerable attention is being devoted to this question, and substantial progress has been made since the war. In the D.O.T.'s report on Belgium, parts of which were summarised in our last issue (p. 557), reference is made to the large extent to which electricity is displacing steam power, not only in the factory but also on the farm. It is stated that courses in the working of electric motors are being given in the majority of the agricultural mechanical schools. In France the great boom that has arisen in the development of hydro-electric power is destined to improve the lot of the rural population. It may be added, however, that the State subsidy provided by recent legislation is being entirely outrun by the applications for grants. These rose from 18 in 1918-19 to 344 in 1920, 531 in 1921, and 449 for the first six months of 1922. The number of rural water-power projects which were granted subventions during the first nine months of 1922 totalled 68, and the sum allotted was seven million francs. For 1923 about nine million francs will be available for such subsidies, whereas the demands are estimated at about fifty millions. The American Commercial Attaché in Paris, who has recently reported on this subject, says that it is now proposed to arrange for the State and the local authorities to give financial support to electric service schemes for rural communities on a "fifty-fifty" basis. If the plans are carried out, it is predicted that they will contribute greatly to the agricultural development of France, by making country life more attractive and lessening the tendency of the agricultural population to migrate to the cities.

The German Electrical Industry.

The reports of the Prussian Chambers of Commerce for March state that the electrical industry suffered from a scarcity of new orders in that month. Electrical installations of all kinds are in great demand, but there is no possibility of raising the necessary capital. In general, it is said that the orders on hand will ensure activity for months to come, although individual restrictions in working have taken place. The home prices have slightly declined, and the export trade is very depressed. We quote in our "Business Notes" some observations from an article which appeared in the *Manchester Guardian Commercial* last week on the general question of foreign capital investment in German industrial undertakings. The observations do not specifically relate to electrical industry, but in view of the peculiar uncertainty in regard to the future, the bearing of all such suggestions upon British and international relations and operations is a matter of interest.

Taxation and Industry.

Sir George H. Fisher-Smith has added his testimony to that of other manufacturing chairmen regarding the signs of trade improvement. Gradual improvement commenced in the latter half of 1922 throughout the engineering trade, and similar signs are still evident. The orders of the company (the London Electric Wire Co. and Smiths, Ltd.) considerably exceed those of a year ago, and Sir George holds that we have passed the bottom of the depression and trade will continue to improve if we can avoid industrial unrest by both sides considering what is best in the interests of industry, but he alluded also to the strangling effect of the burden of taxation upon our industry, preventing business development. We shall know more regarding the intentions of the Government in this matter when the Budget statement is made on Monday next. The public demand for a substantial measure of relief from taxation has been loud and continuous for some weeks past, and an atmosphere has been created, and permitted, which makes it practically impossible for the Chancellor to refuse to satisfy that demand. The easing of our burdens will have an immediate beneficial effect—direct and indirect—upon trade, industry, and investment business, and the psychological influence of a reduction in weight of the bundle strapped upon the shoulders of millions of people will be unmistakeable. Taxpayers and non-taxpayers will both be advantaged by the relief from strain. On the other hand, any disappointment of the now widely prevalent spirit of expectancy could only produce a slump as the result of reaction from present hopes. The Cabinet knows that, and may be trusted to avoid a serious error.

Inchcape in India.

The Indian railways, it will be remembered, decided some time ago to spend £100,000,000 in five years on the rehabilitation of their systems. Consequently the many United Kingdom firms whose material is in high repute in India have been looking forward to sharing largely in the orders. Some anxiety has recently been felt as to whether the Indian Retrenchment Committee would report unfavourably on the railway programme and bring about its reconsideration. Now that the Inchcape Committee's report has reached this country it is possible to examine how far this anxiety is warranted. It is made abundantly clear by the Committee that it considers that some revision in the general method of operating the railways is necessary. It objects to the loss at which the system as a whole is run. Certain lines are found to earn insufficient receipts to pay either interest or sinking fund charges, and consequently have to be subsidised by the general taxpayer. Yet the Committee does not think it practicable to make any general increase in rates and fares without injury to the trade of the country. At the same time it asks that a more definite distinction should be made between capital outlay on new works and improvements connected with renewals on the one side, and expenditure on repairs and overtaking arrears of renewals on the other. With regard to the latter heading, it is held that each line should be dealt with on its merits, and on those that do not pay, such expenditure should be postponed. Apparently the Committee does not condemn in principle the programme of spending £100,000,000 in five years, although it criticises certain details, particularly in connection with the reconstruction of permanent way on the unprofitable lines.

It may be concluded from the report that, logically, a proper application of the Inchcape recommendation should further rather than curtail electrification work on the Indian railways, for it is with regard to suburban systems that the question of economy largely arises, and in such cases it is an established fact that conversion to electric traction will often turn a loss into a profit.

PROSPECTS FOR ELECTRICAL ENGINEERS IN CANADA.—I.

By GEO. R. ARCHDEACON, A.M.I.E.E.

Birth, marriage, and death are generally conceded to be the main landmarks in a man's life; nothing, however, can be more disturbing to one's settled rules and traditions of life than emigration!

Emigration! to tear up the roots of one's profound love and admiration for one's home-land, and all the sweet and tender memories attaching to it.

To contemplate becoming a "foreigner," and have one's children grow up in a strange atmosphere, finally becoming "foreigners" as they absorb so readily the strange atmosphere of this strange land of one's adoption, while the parents are so slow to adapt themselves to this new atmosphere that they awaken to the fact that their own children have in certain respects become "foreigners" even unto them!

Whatever alluring prospects may be dangled before one's eyes by emigration boards and officials, one is slowly forced to the conclusion that the necessity for such a step is because they have failed to achieve the success they once anticipated. Possibly they may have so far failed in their efforts that the land which gave them birth may be quite unable to give them the daily bread of common necessity.

Such thoughts may be full of sadness, and such as to stimulate the imagination to the point that "moves mountains," but when one is about to make such a radical change in one's life and surroundings, it is of the greatest importance that considerable time should be devoted to a little introspective reasoning, before the definite step is taken.

The intending emigrant must probe and search within himself for that, by no means common, quality of adaptability to new customs, climates, and perhaps even language, which must be encountered in the lands other than the dear land of one's birth.

"Why should I be any less a failure in a strange and distant land, where I shall have to start and learn all over again, than I am in my home land, of which I am a product, and with which I am perfectly familiar?"

"Can I, at my time of life, hope to acquire a working knowledge of a new tongue? Can my body adjust itself to the rigours of a climate that is the very opposite to what I have hitherto been accustomed? Can my political ideals sink themselves and never obtrude upon the political ideals prevalent in the land I am moving to? Can I refrain from criticising adversely the customs of a strange country, with which I have no particular sympathy?"

Such are but a few of the all-important questions which must be satisfactorily answered before one should arrive at a decision either for or against emigration.

Assuming, therefore, that the intending emigrant has decided that he possesses a temperament suitable for successful emigration, he must engage upon the adventure with a spirit full of optimism and hope, looking bravely before him determined that he will win success.

The past, therefore, with all its possibilities, pains and problems, must be buried in the deep grave of oblivion and utter forgetfulness.

A new land is calling, a land not yet developed, wherein there is equal opportunity for all, a land where the abilities of your ancestors will avail you nothing should you personally be lacking in ability, a land where you will not be judged by the quality of your accent or the perfection of the "Oxford manner," a land that is not interested in what you *were*, but what you *are*, and what you can do.

Such a land is Canada! a land capable of absorbing to the last ounce all the mental and physical vigour of which a man may be capable, a land possessing many difficulties for the new comer, a land most jealous of her rights, a land which subjects you to a most careful scrutiny before taking you to herself, but a land that *can* and *will* recompense in no uncertain ungrudging manner for all the energies you devote to her service.

Such opportunities, such service, such recompense, such a land is Canada!

Canada! the richest, most important, most powerful of all the Dominions overseas that go to make up the British Commonwealth of nations.

Canada possesses for the immigrant splendid opportunities in such varied fields of endeavour that there is a place for all classes of workers: in its agriculture, manufacturing, mining, smelting, railways, surveying, building, engineering, journalism, art.

Before making a detailed survey of the prospects for electrical engineers, let us just get a "close up" of the country and dispose of some of the strange and wild ideas, which in spite of the penny newspaper, still prevail concerning Canada.

Canadian Fallacies.

Once upon a time several vigorous Canadians, losing patience with the "lordly" Englishmen who were too proud to work, yet didn't consider it derogatory to their dignity to permit their friends and relations in the old land to provide them with a regular remittance (hence the expression "remittance man"), became so disgusted with these "gentlemen" that they decided to keep clear of them, and posted on the gates of their factories and homesteads "No English need apply."

Such is the power of suggestion that for several years this isolated action of a few Canadians was noised abroad and construed into an impression that the whole of the Canadian nation had "no use for Englishmen," therefore it was useless for the English to "apply."

Such fallacious ideas have been engineered and fostered by mercenary-minded persons for some ulterior motive.

The author cannot too strongly deny that any such condition now remains. Canada is most anxious that the country should become the home of Englishmen. Canada does not want to see her fair land and race polluted by the sweepings of Europe. In short, Canada wants "her ain folk."

The Canadian Winter.

One of our supreme sources of laughter is the average Englishman's profound ignorance of things Canadian, especially with regard to our climate. His conception of Canada as a land of snow, ice palaces, wolves and Indians, &c., is a constant source of amusement to us.

Particularly do we enjoy this joke whilst we are pruning our wonderful peaches and grapes which grow out in the open in our gardens, and also when we are picking pansies and violets in November, while our English cousins are wrapped in mufflers and goloshes and carry hot-water bottles to bed.

Another fallacy is that Canada is only an agricultural country, and therefore no place for the skilled artisan.

This would imply that the great preponderance of the population is engaged in agriculture. Let us briefly look into this question.

Canada has an area of 3,729,665 sq. miles, with a population of only 8¾ millions of people.

There are approximately 725,000 farms throughout the whole Dominion. Suppose we assume on the average there are five persons to a farm, this would give us a total of 3,625,000 persons permanently living on the farms.

This would leave a balance of some 5,125,000 engaged in various forms of manufacturing and professional vocation.

Looking a little further we observe that in each of the agricultural areas there are large cities whose function would appear to consist in being manufacturing and supply centres for their respective areas.

Manitoba has Winnipeg with a population of 200,000.

Sasketchewan has Regina and Moose Jaw with a total population of about 70,000, whilst further north still within its area there is Saskatoon, with a population of about 25,000.

Alberta has Calgary with 60,000, with Edmonton on its northern section with a population of about 58,000.

British Columbia has Vancouver, with 175,000, and Victoria with about 40,000, New Westminster 15,000.

Ontario has Toronto 600,000, Hamilton 125,000, London 65,000, Ottawa 125,000, Peterboro 25,000, Kingston 25,000.

Quebec has Montreal 850,000, Quebec City 100,000, Three Rivers 33,000, Sherbrooke 25,000, 60 per cent. French speaking.

New Brunswick and Nova Scotia are much less sparsely populated, yet they need to be taken into account, as they present great opportunities in their extensive coal mining and lumbering operations.

In all the other Provinces enumerated in addition to the cities referred to, there are in each province dozens of small towns of 5,000 people.

The author can assure the prospective emigrant that he is likely to encounter great difficulties if he attempts to locate a farm within any of the city limits of the above-mentioned places.

Even in England such figures as above given would not disgrace the industrial areas of that densely populated country.

It must be obvious that all these people are self-supporting, for be it remembered we have no paternal government paying us "out-of-work wages"—and maintaining us in a state of idleness; the safe conclusion must therefore be that we are maintaining ourselves.

How is it accomplished, and from whence do these people derive their incomes?

To start with, the annual value of manufactured goods in Canada is approximately $3,529,724,000, or translated into English, roughly 700 million pounds sterling.

Not too bad for a "land of farmers"—What?

Canada produces approximately: 90 per cent. of the total asbestos of the world; 80 per cent. of the total nickel of the world; 33⅓ per cent. of the total silver of the world; 28 per cent. of the total copper of the North American Continent.

Canada possesses the largest gold mining camp in the world; the largest forest resources in the world; 250 million acres of land covered with trees suitable for cutting into lumber; a pulp-wood supply of 500 billion feet; Canada produces an annual field crop worth approximately $1,500,000,000, about 300 million pounds sterling.

These are remarkable figures, probably unsuspected by the average Englishman, but let us translate them into standards of living and see what they result in to the average working man of Canada.

Naturally the major portion of this huge revenue goes in paying wages. Should these wages be inadequate, the wage earner must accept a low standard of living; he cannot save, nor can he indulge in any luxuries.

Let us see what the Canadian standard of living means.

The external evidences of a high standard of living may generally be observed by the general appearance of the people, their physique, the style and quality of their personal attire, the style and location of their homes, their general intelligence, educational standards, and their sports, recreations, and amusements.

The author has not attempted to place these in their relative order of importance, but each of them is a reflection on the standard of living the people concerned enjoy.

Their physique is "par excellence"; Canada raised over 500,000 men for the war out of a population of 8½ millions. The British War Office can give a sound opinion on this fact; if not, inquire in Berlin.

Their dress and personal appearance is above reproach, and if anything, is superior to that of any provincial city of England, whilst many of our cities make even London look "dowdy."

Their education and moral tone is splendid; a much greater proportion of our people attend a university than obtains in England.

Our theatres and amusements are much more costly to attend than similar places in England, yet such places are always crowded.

Regarding their luxuries, it must be considered a significant fact that Canada has over 475,000 automobiles registered amongst a population of 8¾ millions, against only 425,000 automobiles in England with her population of over 40 millions, and only 49 per cent. of these are Ford cars.

In this connection it is interesting to pause and reflect that in the City of Toronto there is one automobile to every 18 persons; Province of Ontario, one to every 16; Quebec, one to every 55; Saskatchewan, one to every 13; Alberta, one to every 16; British Columbia, one to every 24; Manitoba, one to every 18; Nova Scotia, one to every 47; New Brunswick, one to every 37.

Granted automobiles cost far less here than in England, but how does this happen when wages are considerably higher than in England?

Granted also that our Government doesn't tax the automobile out of existence as in England; here a Ford car only bears a tax of £3 per annum as against £23 in England, and petrol only costs 17 pence per gallon as against 30 pence in England.

The mere relation of such a fact demonstrates the wonderful financial stability of the country.

From the very statement of such facts the opinion may arise that we are all spending our income as we earn it, without regard to the necessity of saving for that inevitable "rainy day."

Such is a very natural conclusion to arrive at, therefore let us finally dispose of it.

The possession of a home, domestic labour-saving devices, and ample life insurance must surely be satisfactory evidence of the sound financing of the working man's budget.

In the City of Toronto, with its population of 600,000 people, approximately 60 per cent. of the people own their own homes, and these are principally five to seven roomed houses, in well laid and paved streets; slums, as you know them in England, are practically unknown.

A large percentage of the people have the telephone installed in their homes, there being one telephone to every 10 persons.

The great majority of the people possess electric light, and in addition electric irons, toasters, coffee percolators, washing machines, not to mention pianos and "Victrolas."

Should this fail to convince, there are still the Savings Bank deposits, which total approximately 1½ billion dollars.

The average wealth of Canadians—men, women and children—is estimated to be well over $2,000 per head of population, or in excess of 400 pounds sterling.

The life insurance premiums form a stupendous total; practically every man carries in the average about $1,000 insurance.

In view of such figures may we not flatter ourselves that the standard of living is higher in Canada than any other country in the world?

A country that possesses such resources, such a high standard of living, should surely possess also at least an opportunity for any man who is sound in wind and limb, and in addition possesses some special skill in any of the allied engineering trades, and most especially that of electrical engineering.

D

ELECTRO-FARMING.—IV.

The Making of Silage.

By R. BORLASE MATTHEWS, Wh. Ex., A.M.Inst.C.E., M.I.E.E., F.R.Ae.S.

In the issue of the Electrical Review dated March 30th, 1923, there appeared a translation of an article from *Electrotechnik und Maschinenbau*, entitled "Electric Hay Curing in Germany and Austria." This article is of more than passing interest from the point of view of a new use of electricity on the farm. To the central station engineer, the method implies all-night loads (or should one say out-of-working-hour loads) during the summer season. The farmer who employs the process obtains a more nutritious form of silage than he can obtain with an ordinary silo. Further, he does not need to construct silos of such a great height as is required by ordinary present-day practice.

Inadvertently in the translation the process is referred to as "hay curing," whereas it is, of course, a silage process. The product is, like ordinary silage, a heavy, damp, strong-smelling mixture, which is quite different in characteristics from ordinary hay. The grasses that are usually turned into hay can also equally be turned into silage. But it is usually preferable to employ richer and more juicy substances, such as tares or other leguminous plants, as this is the only way that they can be properly conserved for the winter feeding of the stock. At the same time a more nutritive food than ordinary hay is obtained.

By the old rule-of-thumb way of reckoning, "three acres and a cow" was the relative proportion of land required for the production of the necessary food for one animal. If silage and forage crops are employed for feeding, the acreage can be reduced to nearly three-quarters of an acre per cow. That is, the farming becomes very much more intensive, as a vastly greater amount of stock can be supported upon the same area.

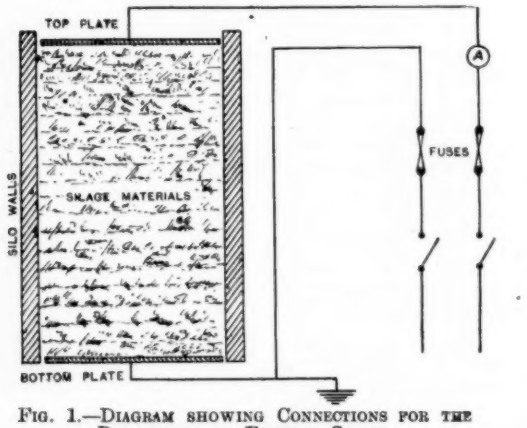


Fig. 1.—Diagram showing Connections for the Preparation of Electric Silage.

Thus the problem resolves itself into an economic one of the balance of rent, rates, taxes, and extra labour *versus* extra returns. The Continental solution of the problem is to adopt the more intensive process, and in view of the fact that progress in other businesses is on lines of greater intensity, it would seem to be the natural line also for farming.

The silo is part and parcel of every American dairy farm, and is rapidly being introduced into England. In one county alone there are already 200 silos. Hence the British farmer is rapidly becoming converted to the advantages of silage, especially as the cost of producing roots such as mangels grows every year. From this it may be deduced that he may reasonably be expected to adopt the further modification, *viz.*, the electric treatment in the process of making the silage. By the way, it is really a heat treatment, with electricity as the medium, as it seems difficult to realise how otherwise the stuff could be so economically and conveniently heated.

The process is being introduced into Switzerland by Messrs. Brown, Boveri & Co., so that it is being sponsored in all the Central European countries by reliable firms. The writer has inspected the process in operation on the Continent, and has also a small experimental silo on his own farm. In first starting this system, a number of practical difficulties are encountered which require a certain amount of patience and skill to overcome them, apart from the prejudice of the average farm labourer against anything that is new. As it is a heating process, either alternating or direct current may be employed. In Germany it is customary to construct three silos side by side where three-phase current is available, as then the phases are approximately balanced. The accompanying diagram, fig. 1, illustrates the general arrangement and connections.

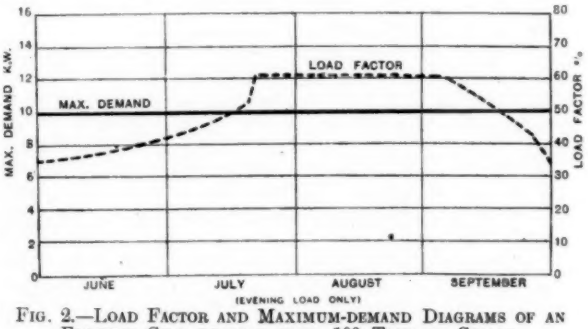


Fig. 2.—Load Factor and Maximum-Demand Diagrams of an Electric Silo dealing with 100 Tons of Silage.

A cow consumes from 20 to 30 lb. of silage per day. This means a consumption of about 2 tons per head for the winter months. Normally 100 tons of silage is provided for 50 head of cattle. On the basis of 23 kWh of electricity used per ton of green material, or say 50 kWh per ton of resulting cured silage, this means about 60 kWh per head per annum—quite a respectable addition to the annual load of a farm. In an area where the applications of electricity to farming are well developed, the total consumption (not allowing for electric ploughing) is of the order of 50 kWh per acre, hence electrically-made silage would double the farm consumption —which would pay the farmer and also the electricity supply undertaking.

About 10 kW is required for a silo 14 ft. in diameter by 20 ft. high. The time for treatment is from 24 to 48 hours. As the material is most conveniently treated in layers, the silo can be gradually filled over a reasonable period of days, so that it is not a case of a rush job, with an awkward maximum demand. This fact also suits the farmer from the labour aspect, in providing for the cutting and cartage of the crops.

The accompanying diagram (fig. 2) shows how the maximum demand and the load factor work out on an electric silo dealing with 100 tons of silage. In future articles on electro-farming it is proposed, where the subject allows, to give approximate load-time curves, such as were given in the article dealing with the load factor of the poultry farm (Elec. Rev., Vol. 91, p. 818).

Cables in Czecho-Slovakia.—In consequence of the steady rise in the price of raw materials in Czecho-Slovakia an increase in the price of locally-made cables has been decided upon.

WIRELESS HINTS FOR ELECTRICAL CONTRACTORS.

By PERCY W. HARRIS.

(*Concluded from page* 529.)

The choice of a set for broadcast reception depends on a number of factors. Crystal sets cannot be recommended for use at a greater distance than about ten or twelve miles from a broadcasting station, although much greater distances are possible if the user is expert and the aerial is large. A three-valve set (either one high frequency, one detector and one note magnifier, or one detector and two note magnifiers) is the smallest that will operate a loud speaker satisfactorily at distances up to twenty or thirty miles. If telephone headpieces are used, much greater distances of reception are possible with such a combination, and if one of the valves is a high-frequency magnifier, such a set will receive from several, and occasionally all, of the British broadcasting stations.

In choosing a set, it should be remembered that high-frequency valves add to the *range*, while low-frequency valves add to the *volume*. An excellent combination, if the listener is situated fifty or sixty miles from the nearest station, is one high-frequency valve, a detector and two note magnifiers, with means of switching on the last two valves separately. Such a set, if provided with reaction, will give enough volume to work a loud speaker, and enough selectivity to tune out the broadcasting stations not desired. It is necessary to be able to switch off the note magnifiers if telephone reception is desired, as the volume with all valves in use is often much greater than one can bear in the headpieces.

A great deal of trouble is being experienced at the present time by listeners in coastal towns at some distance from the broadcasting stations. They find reception of speech and music is almost impossible owing to interfering signals from ships at sea. These ships work on a wave-length of six hundred metres—quite a different wave-length from those used for broadcasting. The trouble is due to the fact that the waves from the ships are so strong that they force most broadcast sets to respond to them, just as a brick thrown at a piano will make all its wires vibrate. Unfortunately most broadcast receivers, and all of the cheapest, are non-selective, but a number of the better-class instruments are sufficiently selective to cut out this interference successfully. The would-be purchaser who lives in a seaside town should make sure before buying a set that it is selective enough for his purpose, or his money may be thrown away.

There are also what are known to the wireless man as "dead spots" in various parts of the country. The reason for their existence is not fully understood, but their existence is none the less real. A "dead spot" is a place where wireless signals from a broadcasting station are far weaker than one would expect for the distance. In many parts of Great Britain where two broadcasting stations can be heard, the more distant one comes in much louder, and it is reported from Aberdeen that, in that city, London is heard better than Glasgow. The experienced supply houses and manufacturers keep records of these places so that their customers may be able to obtain sets sufficiently good for reception there. There are also particularly good spots where reception is much better than would normally be expected.

Within the last year or two a great deal has been heard about indoor aerials and reception of wireless signals on frames or loops of wire and on the electric light mains. In places where there is difficulty in erecting a good outside aerial, a substitute can be provided by indoor wiring, a single insulated wire carried round the picture rail and led down to the instruments proving very satisfactory with valve sets. The usual earth connection is needed. Good reception in telephones is possible up to ten or fifteen miles with one high-frequency valve, one detector and reaction, while at the same distance such an aerial is good enough to operate a loud speaker with one high-frequency valve, a detector and two note magnifiers, reaction being included in the set. In all cases, reaction is practically the equivalent of a further high-frequency valve. Frame aerials, which incidentally have marked directional effects in reception, can be used successfully only when high-frequency magnification is incorporated in the set, and are really very insensitive. In most cases the wire round the picture rail gives better results than the usual frame. The devices sold to plug into the electric light socket are often very good, but widely different results are obtained in different houses. Indoor aerials will only operate crystal receivers when they are situated within three or four miles of a broadcasting station, and even then signals are too weak for most tastes. As a general rule, frame aerials are useless with crystals. They can only be used within a mile or so of the station unless the frame is very large and cumbersome.

Of course, if we have a number of high-frequency valves, we can get results on indoor and frame aerials equal to those we should get with fewer valves on an outdoor aerial. American broadcasting has been received in London on a frame aerial in this way. In passing, we may say that long-distance telephony reception is of a very freakish nature, and sometimes extraordinary distances can be covered with very simple apparatus. W J Z, the famous American broadcasting station at Newark, New Jersey, has been heard in this country many times, some listeners even hearing it on a single valve set with reaction. At other times the same listeners might have used a dozen valves and not heard a sound. To give an example of this freakish behaviour, the present writer one evening failed to hear Newcastle with four valves in London, yet a few hours later on the same set he heard a piano solo, a soprano song, and a tenor song from America, more than three thousand miles away. Quite recently he heard the opera broadcast from Glasgow much louder than the Manchester station's programme, while on other nights Manchester had been much stronger.

Whatever set is used, it is well to erect the best aerial possible, for in this way the valves will be used in the most economical fashion. The wires should be kept well away from projecting foliage, metal work and roofs. It must be borne in mind that it is not so much the height above the ground that counts, but the height *above the instruments*. If the instruments are used on the first floor, the effective height of the aerial will be less than if they are used on the ground level.

Broadcast receivers have already been on the market long enough for us to be able to indicate the chief faults likely to be met with in everyday use. Several are of the kind that any experienced electrician would anticipate, but a number are of a peculiar character and are not so easy to trace.

As might be expected in apparatus containing many soldered wires, loose connections are a prolific source of annoyance, particularly in the cheaper sets made by small manufacturers. Ebonite shrinks somewhat when heated, and no matter how well you tighten a nut against it, if the screw on which the nut runs is subsequently heated with the soldering bit, the nut will loosen. In many parts of the apparatus this may not cause trouble, but looseness of aerial, earth, battery, or telephone terminals will result in the inner wires being

twisted off, and the set will be brought back to the dealer for repair. When resoldering, be sure to tighten any nuts *after* the soldered connection has been made and has cooled. Particular care is necessary in the use of soldering flux, as if any of it runs on to the insulation it may offer a leakage path for the wireless currents. This is especially important in valve sets, where a leakage path having as high a resistance as one or two hundred thousand ohms may cause signals to disappear.

With careful usage the crystal itself in a crystal receiver will remain in good condition for years, but human nature being what it is, some users are not content to leave the "catwhisker" on a sensitive spot, but must needs go searching all over the surface for a better position. As they usually have no standard to judge by, the search goes on incessantly, with the result that what good spots exist are gradually scratched away and the crystal becomes insensitive. If, however, the search is carefully conducted by lifting, and not rubbing, the wire from one spot to another, no great harm will be done.

New crystals are cheap and easily fitted. They are secured in their cups with a special solder of low melting point known as "Wood's Metal." To remove the old crystal, hold a hot soldering bolt against the cup until the solder melts, when the old crystal can be removed with a pin. In fitting the new crystal, be careful not to touch the sensitive surface with the finger, as the invisible film of grease so deposited will spoil its sensitiveness. A pair of tweezers is useful for this work. Ordinary solder must on no account be used, as the greater heat necessary to melt it will injure the crystal.

The faults which occur in crystal sets are usually of an obvious nature, and do not need any special explanation here. With valve sets, however, the faults are often very puzzling. We can pass over troubles originating from short-circuited or faulty accumulators, as these are not particularly "wireless" faults. The high-tension battery is much more likely to puzzle the beginner.

Any good make of high-tension battery will last nine or twelve months in the average broadcast receiver before requiring renewal. When it does give out, it will probably not fail suddenly, but will first of all develop noises. When heard in the telephones, these closely resemble the sounds made by atmospheric discharges, and will increase in intensity until they make reception impossible. The trouble usually develops in one or two cells long before the rest of the battery fails, and if a number of sockets for tappings are provided, the bad section can often be located with the aid of a high-resistance voltmeter. This section should then be permanently short-circuited by connecting a wire between the adjacent sockets, whereupon the battery can still be used for a considerable time, the few volts lost making little difference in signal strength. If several fifteen-volt units are used, the faulty unit can be cut out and a new one substituted.

From time to time the valve will burn out and need to be replaced. A valve of good make will last from six months to a year if properly used, but its life will be short if it is burnt too brightly. Many beginners, in an endeavour to get the loudest possible signals, increase the filament brightness to the utmost, so that instead of about four volts (the usual figure) being applied to the filaments, the whole six volts battery pressure is used. The valve should always be burnt as dull as possible while still giving good signals, and as soon as further brightening gives no appreciable increase of strength, the resistance control should be left alone. When the battery begins to run down, the drop in voltage can be compensated for by a further cutting-out of resistance, but otherwise these adjustments should not be touched after the best positions have been found for the particular valves in use.

Trouble occasionally arises from improper contact between the valve pins and the sockets in which they are fitted. These pins must make proper contact in all four sockets, or poor signals will result. It is easy to see whether the filament pins are making good contact, as unless they are so doing the filament will not glow, but it is not so easy to find whether the grid and plate pins are making proper connection. If there is any doubt, the split pins can be opened slightly with the aid of a pocket knife.

Each make of valve works best at its own voltage, which is always indicated on the box or wrapper. There are several good makes, and often a set will work as well with one make of valve as with another. In multivalve sets it is usually wise to use the same kind of valve in all sockets, as these sets are worked off a common high-pressure battery, and the voltage which is correct for one valve may be incorrect for another.

In low-frequency amplifiers the transformers between the stages of amplification may give trouble through burning out. The wire used in these transformers is extremely fine, and if it has been strained in the winding, there may be weak places which will fuse even at the voltage applied by the ordinary high-tension battery. Sometimes transformers become noisy before finally giving out, but in most cases a sudden cessation of signals is the first indication. The simplest way of testing a transformer for a burn-out is by means of a pair of telephones and a single dry cell. Connect one lead of the telephones to the cell, the other terminal of the cell to one primary terminal, and then tap the free lead of the telephones on the other primary terminal. If all is well, there should be a loud click both at make *and break*. A burnt-out primary will give a click at make, but not at break. The secondary winding should be tested in the same way. When inserting a new transformer, see that the terminal marked "I.P." (in. primary) is connected to the plate of the valve and the "O.P." (out. primary) to the positive high-tension lead. The "I.S." (in. secondary) terminal must be connected to the negative low-tension lead and the "O.S." (out. secondary) to the grid of the next valve.

Telephones, especially the high-resistance variety, occasionally burn out. If they are suspected, each earpiece should be short-circuited in turn, and if signals are restored, the telephone short-circuited is obviously the faulty one. The burn-out is due in most cases to the steady high-tension current passing to the plate of the valve, and not to excessive strength of current from signals. It is not safe to use telephones of a higher resistance than about four thousand ohms on a valve set, as the wire in those of higher resistance is extremely fine and liable to damage. Eight-thousand ohm telephones can be used without risk on a crystal set, as with these sets there is no steady high-pressure current from the battery, but only the rectified current due to the signals themselves. This is rarely strong enough to cause trouble.

Diminution of signal strength is often due to bad joints in the aerial and earth leads. Wherever joints are made in the aerial wires, they should either be soldered or else joined in some other way which ensures a sound electrical contact. Frequently I have found joints made by simply looping the wires together, and while the results have been good for a few days, when corrosion has set in the signals have gradually faded. In other cases new aerials have been made of enamelled aerial wire and the enamel has not been removed at the joints. In such cases, of course, one part of the aerial has been completely insulated from the other.

One of the most satisfactory methods of joining aerial wire is to untwist the strands for about four or five inches, clean them with emery cloth, and then lay the straightened strands along the twisted parts of the opposing wire which has also been cleaned. A single strand of one wire is then wrapped around both the other wire *and* the remaining strands, the process being repeated with both wires until all the strands are wrapped. This will give a very neat and efficient joint, which will remain electrically sound. This method is, of course, well known to telegraph engineers.

At this time of the year, when the leaves are growing

fast, trouble is being occasioned by leakage to earth through wet foliage in contact with the aerial wires. Leaves may also interfere with the lead-in wires. It is important to keep the bare wire well away from anything which may take the current straight to earth instead of through the instruments. The earth wires, too, may cause trouble, either at the point where they are connected to the waterpipe (usually a damp and fairly inaccessible spot) or where they are soldered to an earth plate.

Aerial insulators should be occasionally cleaned, particularly in smoky towns, for the film of carbon deposited by the smoke is a fairly good conductor and may give rise to leakage. There is little to be gained by cleaning the wires themselves, but in districts where there are corrosive fumes in the atmosphere, the enamelled variety of aerial wire is to be recommended in preference to the more usual bare wire. In districts where the air is pure, bare wire will give just as good results.

Trouble in a receiving set may sometimes be traced to the variable condensers made up of sets of interleaved plates (usually of aluminium). These plates are separated by a very small air space, and any grains of dust which have worked their way into the set may cause short circuits and a consequent failure of signals. The well-known woolly pipe-cleaners obtainable from the street hawkers are excellent for cleaning between the plates, and if a trace of oil or vaseline is rubbed on the cleaner before it is inserted, this will help to collect the dust.

On several occasions I have heard of trouble being experienced through pencil marks on the ebonite of a wireless set. Sometimes a line has been drawn between two terminals, and signals have disappeared. This is due to the fact that the graphite of which the pencil line is composed is a conductor, and the wireless currents have preferred to take this non-inductive path rather than the highly-inductive way through the instruments.

In a large number of cases sets are being brought back to the dealer with complaints that they will not work, for no other reason than that the purchaser does not know how to tune them. In spite of the fact that most broadcast receivers are extremely simple to operate, some people disdain to look at the instruction cards and booklets. It is excellent policy to spend half an hour in the home of the purchaser, showing him how to operate the set. The goodwill so created will unfailingly lead him to consult you when he wants a better set or further apparatus to work a loud-speaker. Good business is also to be done by demonstrating loud-speakers in the homes of purchasers of sets not so equipped. If signals are good enough to be heard in one or two pairs of telephones, the addition of a two-valve note magnifier will give strength enough to work a loud-speaker.

Although I have not yet heard of its being done, there would appear to be profitable business in hiring-out loud-speaking equipment for socials, garden parties, &c. No one wishes to wear telephone headpieces in the garden, and in any case it is not convenient to run a number of leads from the instruments across a lawn, but a single long lead can be run from the apparatus to a loud-speaker, which can be placed in any convenient spot, and as the high-frequency currents do not traverse this part of the apparatus, there is no need to take any special precautions in the wiring.

The hints given in this article are meant to be applied in those cases where the dealer cannot conveniently send the receiving apparatus to the makers for repair. It is, of course, by far the best policy to send faulty apparatus to the firm that made it, and the better manufacturers much prefer to do their own repairs. There is, nevertheless, a great deal of "nameless" apparatus in use, and the thousands of home-made sets are not to be ignored. A little help given to an enthusiastic schoolboy may very likely lead to his father coming to the dealer for something "really good," as, once the joys of broadcasting have been sampled, the parents usually want a well-made permanent set.

THE MANUFACTURE OF TIME SWITCHES.

Some Venner Specialities.

The expression "time switch" may be a misnomer, for one does not switch time; however, in that respect it does not stand alone, and by use and wont it has become established as a household word in the electrical industry. In giving it that status no firm has had a larger share than Messrs. Venner Time Switches, Ltd., whose products are known throughout the world, and in the course of a recent visit to their works in Westminster we discovered the reasons why they have attained so high a reputation: in two words, they are "accuracy" and "reliability."

The function of a time switch is to operate at a certain time or times, daily or otherwise, without human assistance, and to do this day after day *without fail*. It resembles, in fact, a miniature automatic sub-station—a subject of which we have heard so much of late—with the difference that the time switch functions at regular intervals on a fixed load, whereas the sub-station depends for its actuation upon the magnitude of the demand; but in one respect they are identical, in that the fundamental purpose of both is to economise in labour. Obviously a time switch which cannot be depended upon to do its work with certainty, or which does it at the wrong time, is worse than useless. How the Venner apparatus is endowed with the qualities to which it owes its success will be briefly indicated in what follows.

In the first place, the efficient performance of the switches depends upon the use of an accurate timepiece—with one exception, namely, the case in which the clock is wound and set every day; 14-day and 45-day clocks have to be of the highest class of design and workmanship, far superior to the ordinary domestic or industrial clock. Moreover, the pendulum type is wholly unsuitable for time-switch purposes; the clock must be of the balance-wheel type, with jewelled pallets and bearings (which are indispensable to accuracy and durability) and a Breguet hairspring, which minimises side thrust on the pivots and otherwise conduces to good timekeeping. The greatest obstacle to the maintenance of a steady rate is not, as commonly supposed, the expansion of the balance-wheel and spring with rise of temperature, but the variation of elasticity of the hairspring with temperature, and this can be almost completely overcome by the choice of a suitable material for the spring, as has been demonstrated by M. Guillaume, director of the International Bureau of Weights and Measures. Another important factor is the mainspring, which, to give uniform running over a period of 14 days, must be exceptionally long (13 ft. or more). It is found in practice in connection with street lighting that a sufficiently close approximation to lighting hours can be made by setting the clocks once a fortnight, but to provide ample margin, the spring is able to drive the clock for 18 days. For many purposes, however, a longer period is required, and a correspondingly long spring is impracticable; hence a stiffer spring with a fusee drive is employed, the variable torque of the spring being compensated for by the varying diameter of the fusee. An important detail is the use of a steel chain with the fusee; the substitution of catgut or stranded wire, as practised on the Continent, is fatal to reliability. As time switches have to be installed under trying conditions, in lamp-posts, workshops, &c., the clocks are specially designed to be dust proof in themselves, so that dust is excluded even when the outer case containing the clock and switch is open.

Turning to switches, it should be remarked that those made by Venners are invariably operated mechanically and not electrically; the more direct the relation between the clock and the switch, the less the chance of a weak link in the chain resulting in failure. Obviously this imposes a heavy additional load on the clock spring, which further emphasises the necessity of first-class construction. In the case of the largest switches it has been found desirable to install a special very powerful spring to actuate the switch mechanism, under the control of the clock, but usually the clock mainspring per-

forms both functions. To reduce the mechanical effort required to the minimum, mercury contact switches have been used most successfully for sizes up to 50 amperes, long experience having enabled the early defects to be eliminated. The actual contacts are copper to copper, the chief function of the mercury being to flood the contacts and lower the resistance; two mercury cups are used in series, giving a double break, and the cups are fitted with special caps which prevent the mercury from being blown out in the event of overload. For larger currents, however,—up to 400 A, 600 V, single-pole and 300 A, triple-pole—an oil-break switch is found preferable.

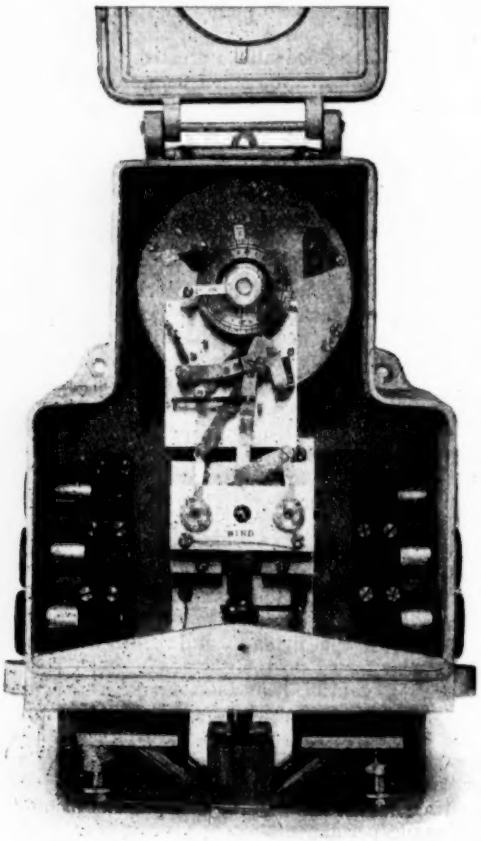


Fig. 1.—Venner "T.O.B." Automatic Oil-Switch; Triple-pole, 100 A, 600 V.

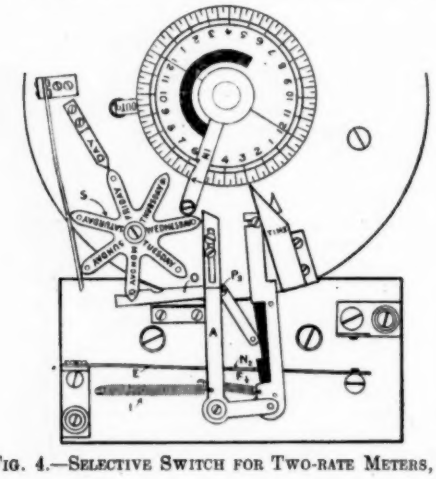


Fig. 4.—Selective Switch for Two-rate Meters, &c.

If the function of the time switch is merely to open circuit, the clock only has to trip the switch, which is put in by hand; this method is often used in connection with the restricted-hour tariff, and as the switch can be opened and closed by hand at all times except during the "out" period (when the clock gear makes it impossible to close the switch), the cost of a separate main switch is saved. But if the switch has to be closed as well as opened automatically, a separate operating spring is provided, which, without the aid of a single gear-wheel, performs the necessary operations for the same period as the clock runs (45 days). This mechanism is applied to the latest type of oil-switch produced by Messrs. Venner, which is capable of switching on and off a current of 400 A at 600 V (fig.1); the oil-switch itself is of the usual type, working in a tank below the case containing the clock and operating mechanism. It might be thought that, for control by a clock and operation by a spring, the oil-switch would be of a type that could be actuated by a gentle effort, placing the minimum load on the mechanism; but this would be a wholly erroneous view. The spring is extremely powerful, and the switch is closed and opened with a rapidity and strength not in the least inferior to the action of solenoid-controlled switchgear. The method by which the same spring is employed for both operations, without the use of gearing, is extremely ingenious; the full force of the spring is exerted directly on the switch, which goes on or off with a resounding bang, offering no chance of failure to act. A rubbing contact is secured, and the sparking contacts are readily renewable. The clock runs for 45 days.

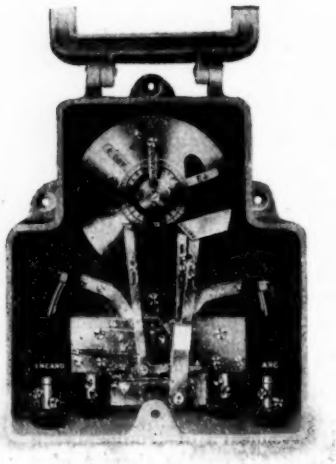


Fig. 2.—Venner "D" Change-over Switch.

Fig. 3.—Section of Mercury Cup and Terminal.

Fig. 2 shows a switch which has been widely used for changing over from one circuit to another, as when substituting glow lamps for arc lamps (or, nowadays, gasfilled lamps) towards midnight, and extinguishing the lamps altogether at dawn. For this purpose mercury contacts are used, carrying currents up to 15 amperes, d.c., or 30 amperes a.c. (fig. 3). The switch is shown in the "out" position. It runs for 14 or 45 days, and can be provided with a selective device (the star-wheel seen in fig. 4) which renders it inoperative on any desired day, or days, in the week; moreover, with an additional star-wheel it can be caused to operate at different hours on different days.

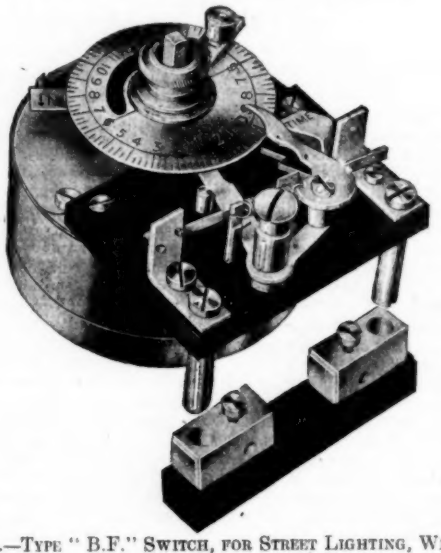


Fig. 5.—Type "B.F." Switch, for Street Lighting, Without Case.

For operating two-rate meters and similar purposes, requiring current up to 3 amperes, the switch is provided with contacts of platinum—the only metal that can be absolutely relied upon

for the purpose. The mechanism is shown in fig. 4, which represents a 45-day time-switch with a selective device which varies the routine on particular days. This illustration shows clearly the 24-hour dial and the pointer (marked "Time") by which it is set, as well as the "in" and "out" hands which actuate the switch. It is a distinctive feature of the Venner switch that these hands are on opposite sides of the dial; consequently they can be set very close together, with a time interval between operations of only 15 minutes if desired. If both hands are in the same plane, obviously they cannot be so set; and further, if the switch is actuated by hand it may be left in the wrong position and be opened by the clock when it should be closed, and *vice versa*. Whilst various methods are used by the makers for attaining their ends, the action of the mechanism shown in fig. 4 may be of interest. The bell-crank lever A carries a detent lever pivoted to the end of its short arm; when the hand marked "in" engages with A, the latter is pushed to the right, bringing the detent (shown black) below a projection N_2 on the flat spring E against which it is pulled by the spring F. When the hand releases A, the latter is pulled back by the spring I against a stop, at the same time raising the spring E and closing the platinum contacts seen on the right. Later, the hand marked "out" engages with the detent lever and pushes the latter to the right, releasing the spring E and opening the switch contacts.

If the above-described routine is to be omitted on a particular day, the star-wheel S and lever O are provided. The hand "in" before engaging with A has to pass the starwheel, and pushes it forward one spoke each day. The arm of S corresponding to the selected day carries at the back a pin which, on that day, tilts the lever O, which is pivoted at P_2; the other end of O presses against the detent lever, and prevents it from actuating the spring E, so that the switch is not closed when A is released by the hand. This switch can readily be arranged as a change-over switch for single and polyphase circuits, or for controlling two circuits at different hours.

Fig. 5 is a simple switch for street lighting, &c.; its mechanism is similar to that of fig. 4, but for convenience of removal for oiling and cleaning it is arranged to plug into the case, as shown, without disturbing any connections. This switch can also be made with a pair of fuses, so that no other switch or fuse is necessary. It runs for 14 days. Without the standard case it measures 3¼ in. high, 2¾ in. wide, and 2¾ in. deep. Space does not permit us to describe further examples of the numerous devices standardised by the firm, but we may mention briefly one or two interesting items, such as the "staircase" switch. This is used to enable the stairs of blocks of flats, &c., to be lighted for a few minutes. A person entering the building presses a button, putting on all the lights; after a predetermined interval (one to four minutes), the time switch cuts them off—but should a second person press the button while the lamps are alight they will remain alight for the full period reckoned from the second operation. A simple time switch is made for shop-window lighting, &c., which can be set every day; for this purpose an accurate timepiece is not necessary, a well-made alarm clock being adapted to actuate a tumbler switch or a knife switch by simple means. This switch, of course, is only used for opening a circuit at a predetermined hour. Time switches are used for an almost unlimited variety of purposes; street lighting, sign and shop window lighting, and metering systems are obvious applications, but new uses are continually being found, and while the company has about 100 standard types, we understand that it produces about 300 modified patterns every year to meet special requirements. Amongst the many out-of-the-way uses are lighting fires, boiling kettles, lighting church clocks, ringing bells (including factory bells to give warning of starting, stopping, and meal times), staircase lighting, intensive egg laying, turning the hall light on and off while the house is closed for holidays (to deceive burglars), water-heating circuits, &c. Sometimes more than one circuit have to be controlled by one time-switch, as when a shop is lighted until 10 or 11 o'clock at night and afterwards a police light is left on until daybreak.

The economy which can be effected by the use of time switches may be illustrated by a recent example—an installation of 1,700 Venner switches. We understand that after allowing for attendance, maintenance, repayment of loan, and interest, a net saving of £4,000 will be shown in the first four years, and a subsequent annual saving of £2,000 a year.

Organising Industry.—A further lecture conference on industrial problems, for works directors, managers, foremen, and forewomen, is to be held at Balliol College, Oxford, from April 19th to April 23rd, inclusive. Mr. B. Seebohm Rowntree is taking a prominent part in the arrangement of the conference. The lecturers will be Lord Askwith, Sir Richard Glazebrook, the Master of Balliol, Mr. Cyril Burt (psychologist to the London County Council), Mr. T. Howarth (works accountant, Messrs. Lever Brothers, Port Sunlight), Mr. T. D. Buttercase (labour director of the Bradford Dyers' Association), Mr. Arthur Pugh (secretary of the Iron and Steel Trades Federation), and Mr. Oliver Sheldon. The elimination of waste in industry will be the general subject of the lectures and discussions.—*The Times.*

LEGAL.

Wareham Electric Supply Co., Ltd.

On April 6th, at the Dorchester County Court, before his Honour, Judge Hyslop Maxwell, an application was made under the Companies Acts, 1908-17, in the matter of this company by Canon Selwyn Blackett, the chairman of the directors of the company, in consideration of an offer made for the purchase of the land, works and plant of the company, that all further proceedings in the formal winding up of the company should be stayed.

Mr. Neville Jones, who appeared on behalf of the petitioner, said that the company was incorporated in 1920 to carry on electrical undertakings. In 1922 it was resolved that the company should be voluntarily wound up and Mr. A. H. Edwards was appointed liquidator. A sale of all the company's assets was duly advertised, but before the sale, an offer of purchase was made on behalf of two Bristol gentlemen. The liquidator recommended that the offer be accepted, and they hoped that by the terms of the offer, and liabilities having been cleared, they would be able to distribute a dividend of 3s. in the £ to the shareholders. His clients, who were buying the undertaking, were paying costs. The whole idea was to get the benefit of this special electric light order. His clients could go to the sale and buy the undertaking at a much cheaper price than what they were giving, but they were getting the benefit of the Electric Light Order. The Electricity Commissioners were very loth to transfer those orders.

His Honour granted the application.

NOTES FROM CANADA.

(From Our Special Correspondent.)

The growth of the loads on some of the systems operated by the Hydro-Electric Power Commission of Ontario during the past few years has been remarkable, and a shortage of power will be felt in no less than nine of the systems in the near future. This is particularly true in the case of the Niagara system, which is by far the largest. It is only twelve months since the first 55,000-h.p. generator was installed at Queenston; now there are four and each of them has been carrying this winter, simultaneously, a load of 60,000 h.p. The fifth generator is believed to be nearly completed and three more of 55,000 kVA each—one from the Canadian Westinghouse Co. and two from the Canadian General Electric Co.—are now on order. The Commission already estimates that the whole of the power to be generated by the Queenston Chippawa Power Development, about 650,000 h.p., will be absorbed by 1926. According to a statement made a few weeks ago by Sir Adam Beck, the Commission has in view the construction of two additional power canals, each of half a million horsepower.

The use of electric cooking ranges, due to the very low rates for energy charged by the municipalities served by the Commission, is very popular, and there are now nearly 19,000 in use in Ontario and some cities have as many as one to every six or seven families. Toronto has been connecting up new electric ranges recently at the rate of 100 or more per month.

Owing to the difficulty of securing adequate supplies of coal in Ontario, which has been experienced this winter, many electric heaters have been made use of to conserve domestic supplies of fuel.

In order to eliminate the risk of breakdown of means of communication due to storms the Commission is having 21 radio stations installed in various terminal and switching stations. Several of these radio stations are already completed and it is expected that they will be very useful in case of need if the ordinary telephone system is out of order.

Extension of rural lines is taking place rapidly; about 1,500 new rural consumers were connected up during the past year and the Commission's work for farmers and in the country districts generally will in time have a decided influence in inducing people to remain in such districts instead of flocking to the cities.

The chairman of the Toronto Hydro-Electric System announced not long ago that by the year 1929 the city would need 235,000 h.p. without counting the requirements of the local street railways (tramways); the load is growing at such a rate as to double itself every ten years at present, although this does not equal the rate for the Dominion as a whole for, according to the Water Power Branch of the Department of the Interior at Ottawa, the load of the Dominion is doubling itself practically every seven years.

The E.C.A. Dinner.—The secretary of the Electrical Contractors' Association is receiving many applications for tickets for the annual dinner, which is to be held on April 24th, and he asks us to state that these are only supplied to members of the Association for themselves and their friends. It is suggested, therefore, that those gentlemen who wish to be present should get into touch with a member of the E.C.A.

THE McLAGLAN SYSTEM OF RESUSCITATION FROM ELECTRIC SHOCK.

As briefly mentioned in a previous issue, Mr. John A. Brown read a paper on "Resuscitation" before the West of Scotland Branch of the Association of Mining Electrical Engineers on February 17th.

The following notes have been abstracted from the *Mining Electrical Engineer*, the Association's journal, in which the paper was reproduced.

The Regulations under the Coal Mines Act (1911) enforce the exhibition of a notice containing directions as to the restoration of persons suffering from electric shock. The methods generally in use are the Sylvester, Schafer, and Labord systems. These treat the muscular and respiratory systems only and leave the nervous system alone.

In most cases of shock life is pronounced to be extinct when it is found that the heart's action has stopped, but a person who has died from shock is not actually dead until the initial stages of putrefaction have set in, as the nerves remain alive long after the heart has ceased to beat.

No definite statement can be made as to just what current strength passed through the body will prove fatal, as this varies with the condition of the individual and the situation. There is no doubt, however, that a current of 1 amp. passing through the brain or vital organs would prove fatal.

The system about to be described, in general, consists of the application of pressure to certain nerve centres, which stimulates the nerves and causes a reaction of the heart. It was discovered by Capt. Leopold McLaglan, after whom it

Fig. 1.

has been named, in Japan, being a development of the ancient "Katsu" system, which appears to have been known as far back as 200 B.C.

The nerves which are affected are those of the pectoral arch (the arch formed by the collar bones or clavicle) where the thinness of the tissues and other matter leaves the nerves to the heart most exposed. The other nerve centres affected are the pneumogastric centre (where the nerves of the lungs are connected to the cerebro-spinal system), and the auditory nerves to the brain.

With the aid of the following figures and instructions it should be possible for any person to apply this system of resuscitation:—

Fig 1.—Place the subject in a sitting position, supported by the operator's right or left knee. Place the thumbs at the pectoral arch and by applying pressure at this point with the fingers resting firmly on the diaphragm of the chest, the pressure is applied with both fingers and thumbs downwards and upwards. This is continued for some time, and the effect is to stimulate the nerves of the heart, which cause the diaphragm to slightly expand and contract, thereby making the subject inhale and exhale.

Fig. 2.—Just as the thumbs are applying the pressure to the chest a blow is delivered by the operator's knee on or about the seventh dorsal vertebra. This tends to stimulate the pneumogastric centres and assists in causing the diaphragm to expand and contract, and by this greater inhalation and exhalation bring the dilation of the heart to its fullest capacity and the blood is circulated through the body.

Fig. 3.—Another point at which the blow can be delivered is the third from the last vertebra, which tends to stimulate the nerves of the spine.

Electric shock undoubtedly affects the whole nervous system and the state of unconsciousness or death itself is thus brought about. This system appears to be the only practical

Fig. 2.

method of bringing about resuscitation, because it deals primarily with the expansion and contraction of the diaphragm, thereby causing the subject to exhale and inhale. At the same time the thumb pressure on the pectoral arch, together with the blow which is delivered on or about the seventh dorsal vertebra, and shouting out as the blow is delivered,

Fig. 3.

stimulates the auditory nerves of the brain, all act as a counter-shock, thereby causing a condition of resuscitation.

Because a person is found apparently dead beside electrical apparatus it should not be at once concluded that he has received an electrical shock. There are a few simple means for ascertaining whether or not this is the case. The person should be examined for signs of burns; in cases of shock the eyes are rendered "foggy," and sometimes a star fracture appears in the eye lens; or the blood may be examined for signs of disintegration.

The system, in common with other methods, may be used in cases of drowning or of unconsciousness due to general shock or accident.

THE RADIO SOCIETY AND BROADCASTING.

We have received from the Radio Society of Great Britain the following memorandum upon broadcasting, which has been handed to the Postmaster-General :—

The Radio Society of Great Britain is an organisation representing about 160 of the wireless societies scattered throughout the British Isles, and about 30,000 persons. The Society includes men of science who have worked upon the fundamentals of wireless, engineers and designers, artisans and operators, and an even larger number of non-professional students of the subject. All these meet with the common ideal of spreading the study of electricity in one of its most fascinating phases among all classes of the community, and join hands in the public-spirited endeavour to foster wireless science in the national interest.

The study of wireless is one of the best gateways to all electrical knowledge. The design and construction of wireless apparatus is a valuable part of electrical education. The practice obtained by actual use of the apparatus is an excellent way of acquiring skill in manipulation, and makes the amateur a participator in the regulation of the world's wireless traffic. All this is immensely to the public advantage; for, in the first place, in our modern electrical civilisation our commercial survival depends upon the attention given to electrical subjects. In the second place, the existence of a nucleus of persons trained in wireless is an important contribution to the national security. In the third place, the wide dissemination of electrical thought produces an atmosphere that fosters electrical ability and facilitates the emergence of electrical genius. Unless this encouragement exists we shall become even more indebted than we are at present to foreign discovery and invention, and we shall have to pay an even larger tribute as royalties on foreign patents than we do to-day.

The Radio Society of Great Britain can, therefore, claim that its activities are in the highest degree of national importance, and it need hardly be said that in spreading a love of the study or practice of wireless the Society is absolutely disinterested. In this spirit the Society has welcomed the advent of Broadcasting for at least two reasons :—It appears probable that all those who listen-in frequently will gain information of the possibilities and of the limitations of wireless intercommunication, and it is probable that some of those who begin by listening-in for amusement may be led on to take a thoughtful interest in this branch of science. The Society, therefore, looked forward hopefully to the rapid multiplication of students, constructors and operators of wireless apparatus.

Three or four months' experience of broadcasting have brought unexpected consequences. For instance, practice in the art of receiving signals with modern apparatus has been made difficult or physically impossible in certain areas at certain times. Again, many new restrictions have been imposed on old licence-holders, and the obtaining of new licences has been made less easy. All this is so clearly against the public interest and affects so many members of the Radio Society that the matter has been forced to the urgent attention of the Committee.

The principal ways in which members of the Society and others are affected adversely may be summarised as follows :—

(*a*) Experimental receiving stations within a few miles of a broadcasting station are jammed so badly that practice in picking up other stations, in learning the Morse code, and in testing apparatus are impossible during the hours usually available to the experimenter. It is even impossible to calibrate a wave-meter for strictly scientific purposes.

(*b*) Experimental transmitting stations are greatly hampered because the co-operating station is jammed and because it is impossible to intercept before transmission on the licensed wave length in the manner required by the permit. A branch of science with high potentialities is thus destroyed during a large portion of each day.

(*c*) The existing broadcasting regulations prohibit an owner from studying or improving his own apparatus. This prohibition if it could be enforced would be an edict compelling ignorance, and would destroy the only chance that broadcasting had of being of national educational value as well as an entertainment.

(*d*) The granting of experimental licences has been made more difficult rather than more easy and serious would-be learners of wireless science are hindered in beginning their studies. This is quite contrary to the public interest, and appears besides to be contrary to the intention of the Act of Parliament. It is said to have led to much evasion of the regulations and possibly to infraction of the law.

(*e*) The selling of apparatus in sealed cases is tending to lower the standard of manufacture and the limiting of designs to certain standard types usable only in this country cannot but react most injuriously upon all attempts to build up an export trade in wireless apparatus.

The Committee collected a number of suggestions for the amelioration of the disadvantages enumerated above. The technical suggestions included the following :—

1.—The Broadcasting stations should be prohibited from emitting high-frequency harmonics or overtones, and should be restricted absolutely to their proper wave lengths.

2.—The power to be employed should not be allowed to exceed an allotted figure.

3.—Modern methods of modulation should be made compulsory.

4.—More blank hours should be arranged for the use of students of wireless, especially on Sundays, and the hours fixed should be adhered to. It is stated that at present the blank hour is frequently filled illegitimately, and the broadcasting station thereby becomes a permanent obstacle to the worker. For the benefit of the listener-in the blank hours might be taken in rotation by the various broadcasting stations.

The Committee also discussed a number of suggestions for the improvement of the present system of licences. As desirable guiding principles it was agreed that every competent British subject must retain his right to possess a licence for experimental work, must remain entitled to construct and to use his own apparatus under the licence, and must not be coerced into paying any sum or sums towards the Broadcasting Co., if he does not use the entertainment they provide, always excepting any proportion of the usual licence fee which the Postmaster-General may allocate to the company.

The following scheme of licensing was agreed upon as likely to be satisfactory to all parties concerned.

Three kinds of licence might be issued :—

(1) The broadcasting licence, for use with apparatus marked B.B.C., fee 10s.

(2) The experimental licence at a low fee for qualified persons not listening-in to the broadcasting transmissions, say 10s.

(3) The listening-in licence, allowing the use of any apparatus, bought or home-made, for the purpose of listening-in, fee 20s. The Broadcasting Co. might supply holders of this licence with a neat badge, changed annually, as acknowledgement of payment of the fee. Such a badge suspended near the apparatus would serve as a guarantee of payment for the entertainment.

The Committee suggested that a fourth kind of licence might be issued to hotels, restaurants, kinemas, &c., costing £5 or £10.

It was agreed that the Society could not accept the suggestion that any form of licence should be endorsed with a requirement that any component parts purchased under the licence must be marked B.B.C. The Society would offer no objection to an endorsement limiting purchasers to components marked of British manufacture.

The Committee decided to put on record its demand that action taken on the above suggestions should not affect the enjoyment or issue of transmitting licences for experimental purposes.

PARLIAMENTARY NOTES.

[By Our Special Parliamentary Reporter.]

The House of Commons re-assembled, after the Easter Recess, on Monday, April 9th.

Radio Transmitting Licences.—On April 9th, Sir R. B. Chadwick asked the Postmaster-General whether, in view of the fact that he had undertaken to lay upon the table of the House the licences to be issued to companies for the conduct of radio services, he would also lay upon the table the licences which had been issued to the various cable companies.

Major Bainston said that licences to land telegraph cables in this country were granted by the Board of Trade and the Post Office in conjunction; but those granted to the principal cable companies were now due for renewal. When the new licences had been issued, copies would, if desired, be laid upon the table.

Municipal Tramways.—On April 9th, Colonel Ashley, Parliamentary Secretary to the Ministry of Transport, informed Mr. Clarry that there were in Great Britain at March 31st, 1922, 159 tramway undertakings owned by local authorities. The total capital expenditure on these undertakings up to that date amounted to £65,085,736, including £8,681,621 for street improvements and old systems superseded. A considerable proportion of the loans raised to meet this expenditure had been redeemed or provided for by accumulations in redemption funds, but the amount was not readily ascertainable. The results of working two minor undertakings not

operated by the owning authority were not available, but he had grouped the results of working the remaining 157 undertakings into six classes:—

Class 1. Undertakings which showed a credit balance for the year after meeting all charges, including capital redemption and reserves. Class 2. Undertakings which after meeting all charges, including capital redemption, made reserves in excess of the amount available from the year's working. Class 3. Undertakings which after meeting interest and capital redemption were unable to meet income tax and other appropriation charges in full. Class 4. Undertakings which after meeting interest charges were unable to meet capital redemption in full. Class 5. Undertakings which were unable to meet interest charges in full. Class 6. Undertakings which were unable to meet their working expenses.

	Class 1.	Class 2.	Class 3.	Class 4.	Class 5.	Class 6.	Total.
Number of Undertakings:	84	9	14	30	9	14	157
Capital Expenditure:	£	£	£	£	£	£	£
	33,056,936	1,430,663	21,839,735	5,378,696	1,713,920	1,420,316	64,839,666
Net Income:	3,519,548	108,446	1,039,493	219,837	64,421	22,801 (Debit)	4,928,987
Capital Charges:	3,222,879	135,838	1,304,617	296,295	134,634	91,706	5,183,969
Balance, dr.	—	27,392	263,124	76,398	70,219	114,507	254,982
Balance, cr.	296,649	—	—	—	—	—	—

Leafield and Cairo Radio Stations.—On April 9th, Major Barnston, replying for the Postmaster-General, informed Sir R. B. Chadwick that the estimates of £49,000 and £36,000 per annum represented the total expenses proper to the Cairo and Leafield Post Office radio stations respectively, including salaries and allowances of the engineering staff at the stations and adequate provision for overhead charges in each case. In calculating the revenue proper to the stations, suitable deductions had been made for the use of the landlines and for the collection and delivery of telegrams. Of the revenue for the nine months, May to January last, about 75 per cent. in the case of the Cairo station, and about 70 per cent. in the case of the Leafield station, was derived from commercial traffic; but if the official traffic transmitted by these stations had not been sent by this route, it would have had to go by other routes at an equal or greater cost; and its value was therefore properly credited to the stations. The Leafield station was opened for traffic about 18 months ago. The revenue was increasing, and was now nearly sufficient to meet the expenses. The revenue of the Cairo station, which was opened less than a year ago, was also increasing, but pending the provision of facilities for radio communication beyond Egypt, it could hardly be expected that the revenue would balance the expenditure.

REVIEWS.

The Quantum Theory. By Fritz Reiche. Pp. v+183; figs. 14. London: Methuen & Co., Ltd. Price 6s. net.

Everyone who is interested in physics, indeed everyone conversant with any of its branches, will have heard, by now, that there is such a thing as the quantum theory. Some will have heard about it, no doubt, with feelings of distrust, such as notions which are subversive of our fixed beliefs in the constitution of things are apt to provoke. Others will have received the news with exultation, as upon the opening of a new window, disclosing new and unsuspected vistas in the heavens. To all alike the book of the above title, now before us, should be welcome. It is a translation by H. S. Halfield and Henry L. Brose of the work of Fritz Reiche, professor of physics in the university of Breslau. The work should be welcome, in the first place, because the circumstances which gave rise to the theory, and indeed necessitated a modification of the classical laws by which the behaviour of matter was supposed to be governed, are nowhere more clearly set forth; and, in the second place, because, while the triumphs of the new theory are described with admirable simplicity, and with as little recourse to mathematical reasoning as the subject permits, its imperfections and present limitations are presented with equal candour and precision. Another merit, and one which will specially appeal to busy people, is that of brevity. The author deals adequately with the origin of the quantum hypothesis, the familiar classical statistics, the development and ramifications of the quantum theory, the extension of the doctrine of quanta to the molecular structure of solid bodies, the application of quanta to the theory of gases, the explanation of optical series by the quantum theory, the quantum theory of Röntgen spectra, the development of the quantum theory for several degrees of freedom, and the phenomena of molecular models—in about 40,000 words, covering 125 pages. Another 50 pages are occupied with mathematical notes and references, by means of which anyone who so desires may hunt up the papers by which the original discoveries were recorded and communicated, and so follow the mathematical investigations as they were originally set out.

The author of this treatise, after surveying the whole structure of the quantum theory in broad outline, as it is now developed, declares his admiration for the achievement it presents, and pays tribute to those few "who clear-sightedly recognise the necessity for the new doctrine and fought against tradition, thus laying the foundations for the astonishing successes which have sprung from the quantum theory in so short a time." The theory, in fact, is just as old as is the century we are living in. Then he goes on to say: "None the less, no one who studies the quantum theory will be spared bitter disappointment. For we must admit that, in spite of a comprehensive formulation of quantum rules, we have not come one step nearer to understanding the heart of the matter. That there are discreet mechanical and electrical systems, characterised by quantum conditions and marked out from the infinite continuity of 'classically' possible states, appears certain. But where does the deeper cause lie which brings about this discontinuity in nature? Will a knowledge of the nature of electricity and of the constitution of the electromagnetic field serve to read the riddle? And even if we do not set ourselves so distant a goal there remains an abundance of unanswered questions. The decision has not yet been made as to whether, as Planck's first theory requires, only quantum-allowed states exist (or are stable), or whether, according to Planck's second formulation, the intermediate states are also possible. We are completely in the dark about the details of the absorption and emission process, and do not in the least understand why the energy quanta ejected explosively as radiation should form themselves into the trains of waves which we observe far away from the atom." "Is radiation really propagated in the manner claimed by the classical theory, or has it also a quantum character?" The fact is that the united efforts of men of science have hitherto been directed to finding an explanation of all material phenomena, which shall show them to conform with the behaviour to be observed in billiard balls. This, at least, was the case until their efforts were distracted by these novel hypotheses. If the conceptions of a hard, impenetrable and perfectly elastic sphere would not suffice to explain a natural phenomenon they were generally able to explain it by conceiving the body under observation to be made up of a number of smaller balls answering this description and subject to various laws analogous to that of gravitation. So we passed from particle to molecule, from molecule to atom, and from atom to electron. To pursue the analogy offered by billiards: the balls were round, the table was smooth and the cushions were perfect; but now pockets have been discovered. The balls are found to disappear mysteriously and reappear in a quite unaccountable manner in baulk. That seems to be the most homely illustration that can be devised to indicate the kind of phenomenon which physicists are now called upon to explain.

A Dictionary of Applied Physics. Edited by Sir R. Glazebrook, K.C.B., D.Sc., Vols. I, II and III; illustrated. London: McMillan & Co., Ltd. Price 63s. per volume.

This work of reference is intended to bring the most approved methods in all branches of the subject within the compass of five volumes, in a form readily available to a person requiring immediate information. The latest results of research are comprised, so that it should prove a valuable adjunct to the library of those engaged, whether in educational work or in those branches of manufacture which are concerned with the application of physics to industry. The manufacturer or his adviser must know where he may find the latest and most accurate information regarding any of the physical processes employed in his business. This information is for the most part stored in the brains of active workers or scattered in the proceedings of learned societies. During the last 25 years the sources of such information have been greatly multiplied. The National Physical Laboratory was opened in 1900 and since that time universities and technical colleges have greatly increased; moreover, recent years have seen the growth of the Department of Scientific and Industrial Research, as exhibited in research associations, studentships and skilled research workers. It is a great thing that an attempt should be made to bring all this new knowledge together within the covers of five volumes, and, judging by the qualifications of Sir Richard Glazebrook and the names of principal contributors to the work, there is every reason to expect that the attempt will be satisfactorily carried out. The contents of the first three volumes now leave little doubt as to that.

Turning over the many pages of this great work, the question forces itself upon us: given a quantity of useful information, by what arrangement will it be rendered most easily available to those who wish to make use of it? Obviously this must depend both on the nature of the information and the nature of those for whose use it is to be made available, and the system adopted must be one the users will understand. If the information were historical a temporal sequence

would be sure to be best, because no one needs the lapse of time to be explained to him. If the information consist of telephone numbers the alphabetical arrangement would be best, because everyone knows his alphabet; but even here a geographical arrangement is superposed, since we must have a separate telephone directory for each town. On the other hand, no one would ever think of presenting the information given in the books of Euclid in the form of a dictionary.

These, and other instances that will readily suggest themselves to the reader, indicate that while the alphabetical system is best adapted for discrete facts related facts are best presented in their natural relations when these are known to the people for whose use the arrangement is made. But how if these relations are but partly known or have been known and partly forgotten? And how if the information can be arranged according to several systems, all of them equally natural? And so we come to information of the kind which it is the aim of this dictionary to arrange in the most satisfactory manner possible. As a matter of fact for information of this kind no one system is satisfactory by itself. The best-arranged treatise on any such subject is improved by a good index; and when the information is arranged, like an index, in a cyclopædia of the subject, some concise treatise is wanted by a new-comer before he can benefit by this system. In other words, a grammar is needed as well as a dictionary. By too close adherence to an alphabetical arrangement repetition is favoured until it becomes impracticably great, so that a dictionary of any science must consist of a number of articles, composed of information logically arranged, and these articles must be put into alphabetical order. It then becomes a question, with hundreds of facts, into which article any one of them should go. Such questions are often very difficult to answer, and although the difficulties are allayed by copious cross references, these also are a tax upon the inquirer's time and attention. Every one must have heard the story, or some variant of it, according to which an inventor in difficulties, when turning over the leaves of a chemical dictionary, happened upon the exact formula he required to perfect his invention. In his excitement at finding his problem solved and his troubles ended he most imprudently banged the book shut. But alas! he had not noted the formula with exactness, and he could never again find the passage it occurred in though he spent weeks looking up every word he could think of in any way connected with the subject.

In the work before us the optimum balance between alphabetical and logical arrangement has been sought; in the first place, by dividing the whole matter comprised into five branches and allotting one volume to each; thus Vol. I, mechanics, engineering and heat; Vol. II, electricity; Vol. III, meteorology, metrology and measuring apparatus; Vol. IV, optics, sound and radiology; Vol. V, metallurgy and aeronautics. There must be many cases where the inquirer will not know which volume to open first, but that is inevitable. In each volume the matter is collected in articles, generally some pages in length, supplemented with cross references, by which whoever consults it may find his way to the particular place where the information he seeks is to be found.

The proof of a pudding is in the eating, and a man must have used the dictionary for some time before he can testify effectively to the convenience of the system upon which its contents are arranged, but so far as we have been able to judge from several tests, the volumes yield up their riches with wonderful readiness, and should prove a boon to all who need to bring themselves up to date, hurriedly, in any branch of the subjects dealt with.

Your Broadcast Receiver, and How to Work It. By Percy W. Harris. Pp. 68, illustrated. London: The Wireless Press, Ltd. Price 6d. net.

This little book is intended to be helpful and interesting to the non-technical owner of a broadcast receiver, and it should certainly attain its ends, as it is clearly written, is full of sound practical information, and contains enough simple theory to make the information intelligible.

The author calls the attention of manufacturers to the fact that the leads of telephone receivers and corresponding terminals on the sets should be marked positive and negative, so that connections may always be made correctly, and the sensitiveness of the telephones thereby prolonged. This is a point which very seldom receives attention, so far as the sets are concerned.

The book closes with a chapter entitled "Reaction: Its Use and Abuse," which those with broadcast receivers would do well to read over, at frequent intervals, to their friends who are fortunate enough to have experimental licences.

The Amateur's Book of Wireless Circuits. By F. H. Haynes. Pp. 107, 111 diagrams. London: The Wireless Press, Ltd. Price 2s. 6d. net.

The circuits are progressively arranged with explanatory notes of a practical nature.

The book is intended to serve the amateur experimenter as a circuit reference book and as a record of devices employed in modern radio practice. It fulfils its purpose well.

The Manual of Up-to-date Organisation and the Science and Practice of Cost and Works Accountancy. By G. T. Turner and B. Wood. Pp. 192. London: The School of Cost and Works Accountancy. Price 10s. 6d. net.

For the cost and works accountant, it is doubtful if a more instructive book has been published than the one under review, and it is a tribute to the authors that so much matter has been compressed into 192 pages without sacrificing detail and reducing the volume to the status of a text-book.

As may be expected from the title, the book is instructive rather than attractive (in the popular sense), although the chapters on organisation and stocktaking form interesting reading, and should appeal to the factory man, as well as to the accountant. In the main, however, it is the latter who will appreciate the form in which the matter is presented, for the "accountancy atmosphere" will prevent the factory man's giving the matter the wholehearted attention it undoubtedly deserves. Still, a manual of works accountancy cannot be expected to follow in detail the actual application of the principle, but if the accountant develops his organisation on the lines laid down in this volume, his aims will be appreciated by the factory man, who will do his part to ensure efficiency in the factory working.

One chapter deals fully with the procedure following the placing of a specific works order, and covers the drawing lay-out; operation lay-out; issue of production orders; requisitioning and purchasing of material; progress; viewing; &c. Other chapters deal with organisation; stocktaking; costing; labour, capital, production and productive labour; double entry book-keeping; and definitions and nomenclature. The volume is illustrated with numerous charts, tables, graphs and records, all of which are of inestimable value to those concerned with costing and accountancy.

BUSINESS NOTES.

Bankruptcy Proceedings.—Cecil Richard Almas Chadfield, 12, Nottingham Street, Melton Mowbray, electrical engineer.—The public examination of this debtor was held on April 6th at the Castle, Leicester. According to the statement of affairs, the liabilities amounted to £492, and there was a deficiency of £397. It appeared that debtor commenced business with practically no capital. After further questions, the examination was adjourned.

A. Greenburgh and W. Price (W. Price & Co.), 29, Russell Street, Plymouth, electricians.—Meeting of creditors, April 18th. Particulars to the Official Receiver, Mr. A. N. F. Goodman, 11, St. Aubyn Street, Devonport, by April 17th. A proposal made by the debtors for a composition of 5s. in the £ (all claims by Jacob Greenburgh to be withdrawn) will be submitted, and is recommended by the Receiver.

L. Contamin, motor and electrical engineer, 9, Wingate Road, Hammersmith.—Receiving order made March 27th on creditor's petition. First meeting, April 16th. Public examination, June 14th, both at Carey Street, W.C.

J. F. Ludlow and R. R. Ludlow (Ludlow Bros.), electrical contractors, 196, Church Road, Redfield, Bristol.—Trustee, Mr. F. W. Darley, Official Receiver, 26, Baldwin Street, Bristol, released March 23rd.

Company Liquidations.—Wm. J. Ferguson (Redditch), Ltd., electrical and mechanical engineers, Redditch.—The creditors interested herein were called together recently at the offices of Messrs. Forsyth, Bettinson & Co., 36, Cannon Street, Birmingham, when Mr. W. J. Ferguson, the liquidator in the voluntary liquidation of the company, submitted a statement of affairs which showed liabilities of £607. The indebtedness to the trade was £256, while there were cash creditors for £196, and the bank was interested for £154. The assets were estimated to realise £270, from which had to be deducted £114 for preferential claims, leaving net assets of £155, or a deficiency as regarded the unsecured creditors of £451. The assets consisted of: Good book debts £112, expected to produce £100; stock-in-trade at market price, £150; and fixtures, fittings and loose tools valued at £20. It was reported that the company was incorporated in May, 1919, with a capital of £1,000, divided into shares of the face value of £1 each. The paid-up capital was £635. No directors' fees had ever been paid. There were no figures available showing the trading of the company, but the liquidator stated that during the first 12 months there was a small profit; since that date there had been a loss. The claim of the bank had been guaranteed by one of the directors. At the date of the passing of the resolution for voluntary liquidation, the Ediswan Electric Co. and the English Electric & Siemens Co. were in

possession, and the amounts due to them had been included amongst the preferential claims. Mr. Ferguson had been appointed liquidator of the company with a view to saving expense. After a short discussion, the creditors decided to confirm the voluntary liquidation of the company, with Mr. Ferguson as liquidator, while a committee of three of the principal creditors was also appointed.

Meegan & Watson, Ltd., electrical engineers, Robin Lane, Pudsey, and Cookridge Chambers, Cookridge Street, Leeds.—The creditors interested herein were called together recently at the offices of the liquidator, Central Chambers, Albion Street, Leeds. Mr. Thos. A. Stoker, I.A., the liquidator of the company, submitted a statement of affairs, which showed liabilities of £1,023. The claims of the trade were £758, while a sum of £200 was set down in respect of a guarantor's claim for the bank overdraft. There was a fully secured creditor for £203, and a partly secured creditor for £265. The latter held securities valued at £200, and was unsecured for the balance of £65. After allowing £30 for preferential claims, the assets were estimated to realise £117, or a deficiency of £906. The assets consisted of book debts £90, expected to produce £50; and surplus from fully secured creditors £97. The deficiency account showed that on November 12th, 1921, there was an excess of assets over liabilities of £474, while £126 had been subscribed for shares in the company. Since November, 1921, the company had traded at a loss of £979. The company was registered in December, 1921, with a nominal capital of £2,000. The issued capital was £626, all of which was fully paid. The vendor received £474 in fully paid shares, while £126 was subscribed in cash. A resolution was passed confirming the voluntary liquidation of the company, with Mr. Stoker as liquidator.

John Finlay & Co., Ltd., 130, Hope Street, Glasgow, electricians, &c.—At a meeting of creditors held recently in Glasgow, it was reported that the shareholders had passed the usual resolutions in favour of voluntary liquidation, and had appointed Mr. W. B. Galbraith, of 87, St. Vincent Street, Glasgow, to act as liquidator. According to the statement of affairs prepared by the liquidator, the liabilities totalled £1,211, of which £770 was due to the trade, and £441 was due to the bank and cash creditors. The assets were estimated to realise £1,580, from which had to be deducted £1,058 for preferential claims, leaving net assets of £522. It was pointed out that the estate showed about 8s. 7d. in the £, subject to the contingencies of realisation and the expenses of the liquidation. The share capital of the company was £5,000, all of which was issued and fully paid up. The premises were held until Whitsun, 1924, and it was pointed out that there might be a liability in that direction of £480. The creditors decided to confirm the voluntary liquidation of the company, with Mr. Galbraith as liquidator.

The principal creditors are:

	£		£
Smith, Thomas & Sons	65	Wood & Cairns	16
Mosie, Alexander	28	Harrison Bros. & Howson ...	16
Orme, Evans & Co., Ltd. ...	19	Patterson Bros.	12
Paterson & Woods	15	Walker, Hunter & Co., Ltd. ...	12

Standard Electric Sign Co., Ltd.—First meetings of creditors and contributories April 17th at Carey Street, W.C.

Leitner Electrical Co., Ltd.—Last day for proofs for dividend April 21st. Liquidator, Mr. H. E. Burgess, Senior Official Receiver and Liquidator, Carey Street, W.C.

Private Arrangements.—S. G. Wilkinson, lately trading as the Wilton Electrical Co., 76, High Road, Wembley.—A meeting of the creditors of the above was held recently at the offices of Messrs. O. Sunderland & Co., accountants and auditors, 15, Eastcheap, E.C., when a statement of affairs was presented which showed liabilities of £3,331. The indebtedness to the trade was £331, the balance of £3,000 being in respect of a cash claim. The net assets were estimated at £635, or a deficiency of £2,696. Mr. C. Latham stated that the debtor had not kept a full set of books. The cash creditor was the debtor's father, who had advanced various sums of money amounting in all to £3,000. The fully secured creditor held various wireless apparatus and parts, the value of which was estimated for the purposes of the statements. The preferential claims included an execution creditor who was in possession. The debtor was of the opinion that his father would withdraw his claim and the estate would then show a surplus. The debtor commenced business last September with a capital of £400. The takings had been in the neighbourhood of £50 weekly, but it was believed that they could be very considerably increased. The debtor stated that he anticipated being shortly in a position to submit an offer of payment of the debts in full. Negotiations were proceeding for the introduction of further capital. After a short discussion, a resolution was passed confirming the deed of assignment executed to Mr. Latham, subject to the father's claim for £3,000 being withdrawn. A committee of three of the principal creditors was also appointed.

J. & D. Solomon, Castle Street, Cardiff, electrical engineers and dealers in wireless goods.—The creditors interested herein were called together recently at the offices of Messrs. Phœnix and Levinson, solicitors, 8, Dumfries Place, Cardiff, when a statement of affairs was presented which showed liabilities of £1,287, all of which were due to trade creditors. The assets were estimated to realise £150, or a deficiency of £1,137. The assets consisted of stock estimated at £75, and book-debts £137, expected to produce £75. The solicitors reported that they were acting for Mr. J. Solomon only, who commenced trading as an electrician at Cardiff in 1918, with a capital of £100. For two years he was successful, and in 1921 he was joined by his brother, D. Solomon. The latter was left in charge of the business, and J. Solomon became a kinema manager at Newport. About that time the trade slump was beginning to make itself felt, and the business at Cardiff did not show any profits. Towards the end of 1921 a kinema at Beaufort was acquired, but it was not profitable and was closed down. A second kinema was taken at Pontnewydd, but it was run at a loss and the landlord forfeited the lease. It was stated that J. Solomon had lately taken no active part in the management of the business and was not aware of the position until a recent date. J. Solomon considered that he had lost something like £1,500 in the business. He had a friend who was willing to assist him, and made an offer of 3s. 6d. in the £. After a short discussion it was decided to accept a composition of 3s. 6d. in the £, payable within three months, and that a deed of assignment should be executed with Mr. S. E. Clutterbuck, of Messrs. Clarke, Dovey & Co., I.A., Cardiff, as trustee.

The following are creditors:

	£		£
Beaufort Kinema	60	Moss Empires, Ltd.	20
Rowntree & Co., Ltd.	17	Film Booking Office	55
Fleet Photoplays	20	Wardour Films, Ltd.	16
Pathé Frères	33	Bowcott, C. H.	12
Pearl Film, Ltd.	13	Phillips Film Co.	25
Servalls Exclusives, Ltd.	17	Beaufort Gas Co.	77
Gaumont Film Co.	11	Park Coal Co.	17
Ideal Films, Ltd.	43	Viking Engineering Co., Ltd. ...	28
Allied Artistes' Corpn., Ltd. ...	25	Haslam & Stretton, Ltd.	55
Imperial Printing Co.	14	General Electric Co., Ltd. ...	185
Walturdaw Co., Ltd.	35	Commercial Electric Supplies	
Metcalfe, J. & H.	38	Co., Ltd.	18
Goldwyn, Ltd.	19	Cardiff Electric & Wireless Co.,	
Phœnix Film Service	15	Ltd.	55

Trade Announcements.—Mr. Gordon C. Lent, electrical contractor, of 15, Churchill Street, London Road, Dover, asks for lists of radio apparatus and parts.

The change of name having been duly passed at meetings of the company, the Indian Electric Supply & Traction Co., Ltd., has now become the Cawnpore Electric Supply Corporation, Ltd. The offices continue to be Orient House, New Broad Street, London, E.C.2.

Messrs. Albert & J. M. Anderson Manufacturing Co., the manufacturers of "Aetna" overhead line and other material for tramways, railways, &c., have opened a London office and warehouse at 12, Moor Lane, E.C. (under the management of Mr. S. C. Hackney) where large stocks are being carried.

Messrs. J. A. Crabtree & Co., Ltd., have opened a London office and showrooms at 50, Whitcomb Street, W.C.2.

Messrs. Ascog, Ltd., state that their telephone numbers have been changed to "Maida Vale 2860 and 2861."

Messrs. H. R. Cleave & Co., of 6, Bristol Bridge, Bristol, have appointed Mr. A. V. Shillcock, 190, Heathfield Road, Handsworth, Birmingham, as their Midland representative.

The electrical department of The Victoria Brass Foundry Co., Ltd., Bonnington Road Lane, Edinburgh, will in future be designated The Victoria Electrical Engineering Co., with office and works at that address. Mr. J. M. Devine will continue as manager. Telephone No. "328 Leith." Telegrams: "Shells, Edinburgh."

The Selby Engineering Co., Ltd., of 92, Fenchurch Street, E.C., has been appointed sole agent by the Navaline Manufacturing Co., of Rotterdam, Holland, for the sale of "Navaline" Lacpaint, a glossy enamel for all painting, regarding which it has issued a booklet.

Mr. J. S. Plumtree has removed to 90-91, High Holborn, W.C.1, where he will carry on business as electrical engineer and wholesale factor. He has resigned his interests in the firm of Marshall & Plumtree, Ltd., and the name of that company will be altered accordingly.

Owing to increased business, Messrs. Mawdsley's, Ltd., of Dursley, Gloucestershire, have opened a branch office at 41, Arcade Chambers, St. Mary's Gate, Manchester, under the management of Mr. G. B. Lowe, who has been their representative in Lancashire and Yorkshire for the past 14 years.

Catalogues and Lists.—Brittain's Electric Motor Co., 110, Cannon Street, E.C.4.—An illustrated circular advertising motors of various types, motor generators, reduction gears, &c., and mentioning the establishment of a repair department.

Messrs. Mosses & Mitchell, Ltd., 122 and 124, Golden Lane, E.C.1.—Two priced and illustrated pamphlets advertising "Vandec" vulcanised fibre waste-paper baskets.

The Embassy Manufacturing Co., 21a, Upperhead Row, Leeds.—A priced and illustrated pamphlet advertising the "Embassy" electric vacuum cleaner.

Messrs. Hick, Hargreaves & Co., Ltd., Soho Iron Works, Bolton.—An illustrated brochure giving a very full description of uniflow steam engines.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2. Leaflet No. B.C. 2940, illustrating (in colour) and describing the "Gecophone" two-valve radio receiving set. Priced.

Messrs. Edward G. Herbert, Ltd., Atlas Works, Chapel Street, Levenshulme, Manchester.—An illustrated pamphlet describing in detail a hardness tester based on the "pendulum" principle.

Mr. O. N. Beck, 11, Queen Victoria Street, E.C.4.—Pamphlets advertising the "F. & R." high-speed braiding machine.

Ateliers de Constructions Electriques de Charleroi, 56, Victoria Street, S.W.1.—April stock list of motors and dynamos.

British Insulated & Helsby Cables, Ltd., Prescot, Lancs.—Pamphlet H.91, containing an illustrated description of "Helsby" magneto mine exploders, shot-firing cables, and accessories.

Messrs. Lehmann, Archer & Co., Ltd., 5, Farringdon Road, E.C.1.—A priced and illustrated catalogue of engineers' taps and dies for Whitworth, gas, metric, and other threads.

Messrs. Hyatt, Ltd., 56, Victoria Street, S.W.1.—Two descriptive lists dealing with ball and roller bearings for industrial and automobile application. Illustrated and priced.

The National Boiler & General Insurance Co., Ltd., National Buildings, St. Mary's Parsonage, Manchester.—Two illustrated circulars dealing with the "National" patent water gauge glass illuminator. Priced.

Messrs. Watson & Sons (Electro-Medical), Ltd., Sunic House, Parker Street, Kingsway, W.C.2.—Bulletin 52S, illustrating and describing the "Canny Ryall" portable diathermy and high-frequency apparatus. Fully priced.

Messrs. Jenson & Nicholson, Ltd., Goswell Works, Stratford, E.15.—A booklet giving particulars of varnishes, japans, enamels, and paints for industrial purposes.

The Dixon Institute, 195, Oxford Street, W.1.—Particulars of a competition in connection with "Robbialac" white enamel.

Automatic & Electric Furnaces, Ltd., Elecfurn Works, Farringdon Road, E.C.—An illustrated card advertising "Wild-Barfield" furnaces, with a perforated portion for the use of inquirers.

British Insulated & Helsby Cables, Ltd., Prescot, Lancs.—Pamphlet P. 177, dealing with "Prescot" jointing compounds.

Shell-Mex, Ltd., Shell Corner, Kingsway. W.C.2.—A brochure describing 56 grades of oil for marine and industrial lubrication.

For Sale.—Assets Auction Co., Ltd., will offer for sale by auction on April 18th and following day at 119-121, Newington Causeway, S.E., electrical accessories, wireless equipment, &c.

By direction of the Disposal and Liquidation Commission, Messrs. Anderson & Garland will sell by auction on April 17th, at C.S.D. No. 1,101, Lemington-on-Tyne, and Depôt No. 7, Blaydon-on-Tyne, plant and machinery, including electric power plant, cables, electric lighting equipment, &c. (See our advertisement pages to-day.)

The General Engineering Exhibits at Wembley, 1924.—We have received from the British Engineers' Association a ground plan showing the progress of space letting in their shipbuilding, marine, mechanical and general engineering section of the British Empire Exhibition, covering an area of 217,000 sq. ft. in the Machinery Hall. The first allotment of space was made a fortnight ago, and the plan shows the progress already achieved in the sale of stand space. The recent controversy regarding the exhibition has not interfered with the B.E.A. activities in this matter. The Association has evidently been getting on with its job in a workmanlike way, with the result that the organisation of its section is already so far advanced that success may be regarded as assured. The space plan is accompanied by a schedule giving the dimensions, frontages and prices of the stand spaces still available when the plan was printed. It must now be understood that firms who have not yet booked space should make up their minds and send in their applications without further delay, as the limited number of stand positions still available will be allotted on the basis of priority of application. Copies of the plan and schedule and any other information required can be obtained from the British Engineers' Association (Inc.), 32, Victoria Street, London, S.W.1.

Indian Machinery Imports.—In his recent review of the trade of India, the Director-General of Commercial Intelligence gives a table showing the relative importance of the United Kingdom, the United States, and Japan in meeting India's requirements of machinery and millwork, including belting for machinery, and printing machinery:—

	1913-14. Per cent.	1919-20. Per cent.	1920-21. Per cent.	1921-22. Per cent.
United Kingdom	90	67	79	83
United States	3	30	17	13.2
Japan	—	1	.5	.1
Other countries	7	2	3.5	3.7

Detailed statistics of the value of India's imports of electrical goods are given elsewhere in this issue.

New Italian Companies.—There has been formed at Rome the Società Elettrica Agricola di Romo, with a capital of 300,000 lire, for the application of electricity to agricultural purposes.

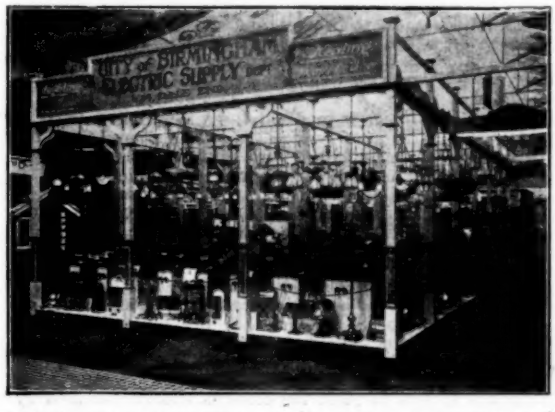
At Milan has been embodied the Società Anonima Zerowatt, with a capital of 1,000,000 lire, for the manufacture of electro-thermic and electro-medical apparatus.

The Società Anonima Impianti Idroelettrici Alto Sero has been formed at Milan for the construction and working of hydro-electric plants. Capital, 100,000 lire.

New Contract Conditions at Liverpool.—Owing to the Liverpool Corporation list of contractors having become so cumbersome as to be impracticable and to stand in need of constant revision, the Finance Committee has recommended its discontinuance. The committee suggests that the tenders for all contracts of a value of £200 and over should be invited by advertisement in future, and that for contracts of a lower figure the method of inviting tenders should be left to the discretion of the committee having control of the work. For large constructional works, or works requiring special knowledge, it is suggested that the committees should be empowered either to invite tenders by advertisement or to invite tenders from a selected list of contractors of well-known financial standing and experience. It is also recommended that the nationality form should no longer be required from competing contractors.

Local Exhibitions.—Wimbledon.—We regret that, in giving a list of the exhibitors at the recent Wimbledon Corporation electrical exhibition in our issue of March 30th, we omitted to mention Messrs. Pooley & Austin, who were present.

Birmingham.—The accompanying illustration shows the stand arranged by the City Electric Supply Department at the National Trades and Industrial Exhibition held at Bingley Hall, Birmingham. The following eight firms participated



Birmingham Electricity Supply Stand at Bingley Hall.

in the show depicted:—British Brass Fittings, Ltd.; the British Thomson-Houston Co., Ltd.; Callender's Cable and Construction Co., Ltd.; the Edison Swan Electric Co., Ltd.; the Hobart Manufacturing Co., Ltd.; the Metropolitan-Vickers Electrical Co., Ltd.; Veritys, Ltd.; and the General Electric Co., Ltd. Over 250,000 people have visited the stand.

Unemployment.—The number of persons registered as totally unemployed on April 3rd was 1,284,000, or 41,476 more than previously reported. The total number of "short time" workers was 55,700, a small increase.

Since January the number of unemployed has fallen by over 200,000.

British Trade Mark Applications.—The following are included among the recent applications for British trade marks. Objections may be lodged within one month from the dates mentioned. In the case of foreign applications the names and addresses of the British representatives are also given.

Columbia. No. 423,310. Class 8. Dry cells (electric).—National Carbon Co., 30, East 42nd Street, New York, U.S.A. (Marks & Clerk, 57-58, Lincoln's Inn Fields, London, W.C.). March 28th, 1923.

Sag. No. 428,583. Class 8. Electric accumulators and batteries (not medical), electric lamps, induction coils, &c.—Starkstrom Apparatebau Gesellschaft, 5, Uferstrasse, Berlin, N20, Germany (Herbert Haddan & Co., 31-2, Bedford Street, Strand, London, W.C.). March 28th, 1923.

Formica. No. 428,953. Class 50. Electric insulating compounds.—The Formica Insulating Co., 4614-28, Spring Grove Avenue, Cincinnati, O., U.S.A. (Boult, Wade & Tennant, 112, Hatton Garden, London, E.C.). March 28th, 1923.

Claritone (lettering and design). No. 431,716. All goods in Class 8.—The Automatic Telephone Manufacturing Co., Ltd., Milton Road, Edge Lane, Liverpool. April 4th, 1923.

Vitalis. No. 431,999. Class 8. Electric batteries and accumulators.—F. S. White & Co., Clough Works, Gardner Road, Prestwich, Manchester. April 4th, 1923.

BT. (lettering and design). No. 432,247. Class 8. Electric batteries, not for medical purposes.—Biggar, Tulloch & Co., Ltd., 144, St. Vincent Street, Glasgow. April 4th, 1923.

Wireless Equipment (lettering and design). No. 433,215. Class 8. Wireless telegraph and telephone instruments and apparatus and parts thereof.—Wireless Equipment, Ltd., 90, Charing Cross Road, London, W.C. April 4th, 1923.

Falco. No. 432,190. Class 13. Electric irons, electric kettles, and similar electrically-heated domestic utensils.—The Falkirk Iron Co., Ltd., Grahams Road, Falkirk, N.B. April 4th, 1923.

New French Companies.—There has been formed at Paris (59, Rue Ganneron), a company styled Construction Electro-Mécaniques d'Asnières R. Knoll et R. Marie, for the manufacture and sale of telegraph, telephone and wireless material. Capital, 100,000 fr.

With a capital of 5,500,000 fr. has been established at Paris (241, Boulevard St. Germain), Le Taxiphone Compagnie pour l'Exploitation en France des Téléphones Automatiques. The company's objects are the working of certain patents of the Hall Telephone Accessories, Ltd., and the carrying out of contracts for the introduction of the Hall automatic telephone into the French Government's service. The capital may be raised to 10,000,000 fr.

With the title of Lyon-Electricité has been embodied at Lyons (258, Rue de Créqui) a company to trade in electrical apparatus. Capital, 230,000 fr.

J. Eppler et Cie is a company established at Paris (62, Rue Coumartin), with a capital of 325,000 fr., for the sale of licences to manufacture the Gamain light generating apparatus in Spain, Portugal, Switzerland, Sweden, Norway, and Denmark.

Le Téléphone Privé is the designation of a company formed for the sale specially of telephone apparatus, but generally to carry on all other operations relating to electricity. The capital is 500,000 fr. and its offices are at 18, Rue du Faubourg-du-Temple, Paris.

Copper and Lead Prices.—Messrs. F. Smith & Co. report April 11th:—Copper (electrolytic) bars, £82 10s., 20s. decrease; do. do. sheets, no change; do. do. wire rods, £92 10s., 20s. decrease; do. do. h.c. wire, no change

Messrs. James & Shakespeare report April 11th:—No change in last week's prices for copper bars, sheet and rod, or English pig lead.

The Failure of German Capital.—A German correspondent writing in the *Manchester Guardian Commercial* on the penetration of foreign capital into Germany, says: "Never in the history of capitalist enterprise has there been such danger of the whole industry of a highly-developed industrial country passing into foreign ownership and control as in Germany since the war. There have been cases in which the new owners have acquired German patents and manufacturing secrets, technical experience, and even machinery for the benefit of their own works abroad. Factories have been converted because the quality and price of their production has meant inconvenient competition with the home products of the new owners. On these occasions there has been no regard for the profit-earning capacity of the German works, the main point being to get rid of the competitor. The failure of German capital to meet the crisis is clearly indicated by the movement of German share values, which are much below their proper level if measured in terms of foreign money. The only solution is for German industry to accept, with as little injury and loss of independence as possible, the assistance of foreign capital. The ways in which this protection can be secured are limited in advance by the Versailles Treaty. Thus, companies are restricted to the measures which they can take within the limits of their own articles without coming into collision with existing laws and treaties. The best and most effective means of protection has been found in the preference share carrying the right to a multiple vote. It has to be admitted that this is often resorted to even where there is no danger of alienation when the board of a company desires to obtain a controlling vote. The risk of alienation is sometimes a welcome pretext for the issue of such preference shares. The best protection against attacks from within and against the risk of alienation would probably be the setting up of an inspection department for joint stock companies. A commissioner from this department should take part, with a right of suspensory vote, in all general meetings dealing with alteration of articles, reorganisation of works, reduction of existing preference shares or debentures, participation in other concerns at home or abroad, sale or stoppage of important machinery, or cessation of work normally maintained. In cases where the commissioner regarded it as necessary to impose his vote, an arbitration board could automatically come into play, composed of two representatives of the organisation whose resolution was questioned, two experienced economists, and an official of the Ministry for Economic Affairs as president."

Foreign Exhibition.—Belgium.—The Fourth Brussels Commercial Fair was opened on April 9th. The number of exhibitors shows a slight increase; there are 1,529 Belgian firms, and among the foreign exhibitors Great Britain takes the second place with 97 firms, which is a similar representation to that of previous years.

Trade with Poland.—Mr. R. E. Kimens, C.M.G., Commercial Secretary to H.M. Legation at Warsaw, will be in attendance at the Department of Overseas Trade for one week commencing on April 18th. During that period United Kingdom manufacturers and merchants interested in the trade with Poland will be able to confer with him by appointment by communicating with the Comptroller-General, Department of Overseas Trade, 35, Old Queen Street, London, S.W.1.

Sale of Russian Electrical Shares.—The *Board of Trade Journal* states that certain shares in the Société d'Electricité de St. Petersburg (1886) will be sold by the Finance Service of the Reparation Commission in Paris on April 19th. Only Allied Governments or that of the United States, or their nationals, will be allowed to participate in the sale.

A Dutch Undertaking.—The report for 1922 of the General Netherlands Electrical Co. (late Groeneveld, Ruempol & Co.), of Amsterdam, states that it was not possible to obtain sufficient orders to be able to work at full capacity. This was particularly the case in the installation construction department and the sales department. It was, however, possible to reduce the general expenses through the concentration of operations in the new works and office buildings. The gross profits amounted to 60,450 fl., and after writing off 43,000 fl. the balance has been carried forward. This result compares with a loss of 865,000 fl. in 1921.

The State of the Swiss Machine Industry.—The *Board of Trade Journal* for April 5th publishes lengthy extracts from the Report for 1922 prepared by Mr. E. C. D. Rawlins, Commercial Secretary to the British Legation at Berne. We quote the following references to the machine industry:—"Switzerland, with her high rate of exchange, has felt the crisis more keenly than her neighbours. Unemployment statistics clearly show the true state of affairs. The foreign markets to which Switzerland used to export have, in part, been closed by protective tariffs. The home market has fallen off, and foreign countries have been able to increase their exports to Switzerland, mainly owing to their low rate of exchange. The industry is said to have never in its history known such a slack time, the number of workmen employed in the industry having dropped by 18 per cent., and only very few firms having been able to work without reducing their working hours and the number of their men. Many suggestions have been put forward, and many attempts have been made for the relief of unemployment. Assistance in the shape of export premiums, which would act as a sort of compensation for the difference in the cost of production in Switzerland and in foreign countries, would not appear to be practicable owing to the long period during which machinery contracts have to run until they are completed. It is also feared that such a system of export premiums, if introduced, would probably produce retaliatory measures in other countries. The best course for Switzerland to take would appear to be a policy of granting Government loans to countries with a low rate of exchange, as has already been done in the case of Rumania. It is naturally hoped that the loan to Rumania, no doubt made conditional to orders being placed in Switzerland, will prove a success, and will induce the Swiss Government to follow this course in the case of other countries with a low rate of exchange and thus assist the Swiss industries in securing orders which would otherwise be placed elsewhere.

"The general view taken in industrial circles is that a reduction in the cost of production is the only possible way of eliminating the present distress and trade depression. The reduction in wages only has been exceedingly slow, and reductions in prices have not been possible to the extent desirable. Public opinion has it that the present working hours, as laid down by the Factory Act, should be changed so as to enable the industries to work more hours per week than the 48 fixed by law. The Government appears to begin to realise that the working hours must be adapted to the present day conditions, and that hard and fast regulations, restricting hours of work to 48 per week, are out of date and are not justifiable. Prospects as regards the future are poor, as no one can tell how long the present crisis will last, nor are there any visible signs of improvement."

The Royal Wedding.—Boys representing thirty great British industries have been invited to attend the Royal Wedding on April 26th. The Duke of York, as President of the Industrial Welfare Society, recently expressed a wish that industry should be represented in this way, and from among the Society's member firms thirty were selected by ballot from as wide an area as possible, and each of the firms concerned was asked to nominate one of its boy workers. Those chosen include five from large engineering firms, three from shipbuilding companies, and one from an electrical firm (the General Electric Co., Ltd.).

Engineering Trade Results.—Owing to the adverse effects of the trade depression in agricultural and general engineering during 1992 the directors of Clayton & Shuttleworth, Ltd., do not recommend a distribution on the 5 per cent. cumulative preference shares.

Messrs. Gwynnes, Ltd., report that the only addition to their credit balance brought forward was £6,762 due to completion of adjustment of accounts left over from the war, and did not represent actual trading profits. Gwynnes Engineering Co., in which Gwynnes, Ltd., are largely interested, has not been in a position to make any cash payments to the latter company, having required all its available resources for manufacturing and trading purposes. With the prospect of the business of the former company materially improving, the directors of Gwynnes, Ltd., recommended deferring dealing with a capital account adjustment scheme.

Messrs. Fairbairn, Lawson, Combe, Barbour, Ltd., are able to pay 14 per cent. on the ordinary shares for the year. They state that for over 13 weeks the business was at an almost complete standstill owing to the engineering lock-out, and the slackness in the industry also affected the company and its associates. There are now signs of distinct improvement. The company's Indian establishment has been practically completed, and production there has commenced.

Argentine Customs Rules.—The Anglo South American Bank, Ltd., which has prepared a number of useful reports on Argentine trade in various lines of goods, has now added a guide to the Argentine Customs Tariff. It has been issued by the Department of Overseas Trade. The principal purpose of the report is to give British merchants and shippers a sufficient indication of the requirements of the Argentine Customs laws as will enable them, in some measure, to avoid those errors or omissions that are so apt to strain relations between shipper and importer. It has naturally been found impracticable to include a complete schedule of the rates of import duties, but tables are given showing how to calculate the costs of storage, loading, crane service, and minor charges.

It is laid down that electrical articles, if imported in bales, bags, or rolls, are dutiable on the gross weight; if imported otherwise they shall be weighed together with the paper wrappers, packing, cardboard, or wooden boxes or reels, except in those cases where the mode of weighing is specially determined. Lamps of bronze, nickel, or nickelled, shall be considered as such even if they have an iron base plate. Articles that are nickelled or polished shall be expressly declared as such, under pain of increase in the valuation of 25 per cent. and 15 per cent. respectively. Incandescent lamps of all classes, including Nernst lamps, pay duty on the gross weight. Switchboards are valued at $2.00 gold per switch.

Electric wires and cables pay duty according to (1) diameter, (2) the class of covering. Wires or cables of copper covered with rubber, or cotton, or similar substances, up to five millimetres inclusive in diameter are valued at 70 cents gold per kilo and pay 25 per cent. Of a greater diameter than five millimetres, with the same class of covering, the valuation is 60 cents gold, but the duty payable is only 5 per cent. The diameter is considered to be that of the uncovered wire. Wire covered with lead up to five millimetres in diameter is valued at 50 per cents gold per kilo and pays 25 per cent., over five millimetres the valuation is the same, but the duty only 5 per cent. Lead-covered wires of any diameter are valued at 15 cents gold per kilo, with a duty of 5 per cent.; covered with silk of any diameter, the valuation is $2.50 gold and the duty is 25 per cent.

Concessions in Russia.—Apart from the concession recently granted by Soviet Russia to the Swedish Ball Bearings Co. to carry on manufacturing and sales from its own works in Moscow, it is stated that the Swedish Ericsson and Cedergren companies are negotiating with a view to the resumption of business in Russia. The Swedish General Electrical Co. is also reported to be in negotiation with the Soviet authorities, although not for obtaining a concession.

Book Notices.—The Special Annual Supplement issued by the Johannesburg *Star* on March 14th deals with many aspects of the finance and industry of South Africa. The mining interests naturally occupy an important place in the publication, but engineering, tramways, and railway electrification are also dealt with. Copies of the issue, with supplement (price 2d.) can be obtained from Argus South African Newspapers, Ltd., 82-85, Fleet Street, E.C.4.

"The Marine Gear Problem from an Underrated Aspect," by Wm. Sellar (54 pp.). London: The Association of Engineering and Shipbuilding Draughtsmen. Price 2s.

"Industrial Mathematics," by P. V. Farnsworth. Pp. viii+273; figs. 250. London: Scott, Greenwood & Son. Price 8s. 6d. net.

Kempe's "Engineer's Year-Book for 1923." Pp. lxxxix+2,803. London: Crosby Lockwood & Son. Price 30s. net.

"Industrial Electric Heating," by J. W. Beauchamp. Pp. x+118; figs. 42. London: Sir Isaac Pitman & Sons. Price 2s. 6d. net.

LIGHTING AND POWER NOTES.

Bath.—New Mains.—The Town Council has decided to lay new mains in certain parts of the town at a cost of £10,000.

Blackpool.—New Plant.—The Electricity Committee has decided to dispose of the old-type 1,000-kW "Willans" steam turbine at the electricity works and substitute a 1,250-kW high-speed geared turbine, and the electrical engineer has been instructed to obtain tenders; the cost will be charged against the reserve fund.

Bradford.—Loans.—The Electricity Committee has rescinded resolutions of April and November, 1921, regarding applications to borrow £55,480 and £650, and has now applied to the Electricity Commissioners for sanction to borrow £49,797 for electricity purposes. The Town Clerk has also been instructed to apply for sanction to the borrowing of £12,172 to cover the cost of e.h.p. switchgear for the Valley Road works.

The Corporation Finance Advisory and Co-ordination Committee has approved applications being made to the Electricity Commissioners for sanction to the borrowing of £145,000 for new plant.

Canada.—New Shawinigan Plant.—The Shawinigan Water and Power Co. has recently put into operation an additional generating set developing 45,000 h.p. This makes the capacity of the company's plant 200,000 h.p., and, in addition to this, a further 125,000 h.p. is purchased from an outside source. The steel penstock which guides the water to the turbine is 77 ft. in length, and contains what is said to be the largest valve in the world—23 ft. in diameter and 27 ft. long. The valve and turbine were made by the Dominion Engineering Works and the generator was supplied by the Canadian General Electric Co.

Hydro-Electric Development.—The contract for the construction of the Kenogami dam, one of the most important hydro-electric developments in the Province of Quebec, has been awarded to the Nova Scotia Construction Co., Ltd., and work will be commenced shortly. The contract price is $985,682, and the expropriation of the area to be flooded will cost about $800,000. The total outlay is estimated at two million dollars.

The Hydro-Electric Commission has requested the Provincial Government to approve an expenditure of $1,066,408 for the purpose of developing additional power on the Trent River, to relieve the power shortage in Central Ontario.—*Reuter's Trade Service.*

Continental.—France.—A large hydro-electric scheme on the River Ardeche will be shortly placed on hand. It consists of a dam 32 km. long and 32 m. high across the river. The estimated power to be obtained is 32,000 kW. It is expected that the cost of the scheme will be 75,000,000 fr., and that it will take eight years to carry out the work.

Corsica.—A scheme is being prepared for the supply of electricity in Corsica. Four generating stations will be built—one at Laucom (1,600 h.p.), one at Tavignano (1,250 h.p.), a third at Tarrano (2,250 h.p.), and a fourth at Fiurmorbo (3,200 h.p.). The yield expected is 25,000,000 kWh yearly. The 20,000-V h.p. lines will total 550 km. in length, and the subsidiary 5,500-V lines 1,450 km. The initial cost of the scheme will be 45,850,000 fr.

Doncaster.—Loans.—Following a report by the borough electrical engineer with regard to the proposed provision of additional converting plant and mains, the Corporation Electricity Committee has recommended that application be made to the Commissioners for sanction to the borrowing of (*a*) £7,650 for a new 1,250-kW rotary converter, with switchgear, and (*b*) £18,750 for mains, services, and meters. Application is also being made for sanction to the borrowing of £2,808 for the provision of mains and services in connection with an extended housing scheme for the Bentley Urban District Council.

Droitwich.—Electricity Supply.—The Shropshire, Worcestershire, and Staffordshire Electric Power Co. has notified the Town Council that steps are being taken to provide the district with an electricity supply from Redditch, *via* Bromsgrove.

Eston.—An "All-Electric" House.—The Urban District Council has opened an "all-electric" house with a view to encouraging the residents to use domestic labour-saving devices.

Helston.—Electricity Schemes.—The Town Council has under consideration two schemes for providing an electricity supply for the town. One is to obtain a bulk supply from the Cornwall Electric Power Co., and the other is a hydro-electric scheme suggested by Messrs. Hay, Maryon & Co. It was pointed out at a recent meeting of the Council that if a bulk supply was obtained, the estimated cost to the consumer would be from 1s. to 1s. 3d. per kWh, and the cost of laying mains from the power company's works would be £7,000. The Town Council has instructed Messrs. Hay, Maryon & Co. to submit details of the proposed hydro-electric scheme. The Electricity Commissioners have intimated that they are prepared to approve of the water-power scheme, provided that the cost is less than that of a supply of electricity in bulk.

Irish Free State.—Wicklow.—The Urban Council is to proceed with a scheme for the public lighting of the town by electricity. The Council has now been notified that its Electricity Order has received official approval. The Order empowers the Council to raise a loan of £6,000.

Howth (Co. Dublin).—The Urban Council has announced that the electric lighting scheme is now nearing completion, and will be in operation in about two months.

London.—Hackney.—*Feeder Pillars.*—The electrical engineer having reported that the loads on several feeders are becoming too heavy to be dealt with in underground boxes, the Electricity Committee recommends the replacement of ten of these boxes by surface feeder pillars. The cost of each pillar is estimated at £80, and the cost of cutting out each existing feeder box and erecting a pillar is given as £70, making a total of £1,500 for the whole work.

Extension of Sub-station.—As the load on the Dalston Lane sub-station is approaching the capacity of the plant (3,000 kW), the Committee recommends the extension of the buildings and the installation of a 1,500-kW Peebles-La Cour converter set,

together with switchgear, the latter to be provided by Messrs. Johnson & Phillips, Ltd. The estimated cost is as follows: Building extension, £4,200; converting set, £5,900; switchgear and cabling, £4,750; total, £14,850. The Electricity Commissioners are being asked to sanction the borrowing of this amount.

Hot-water Supply.—The Committee recommends that a charge of .6d. per kWh be made for the heating of water in special apparatus of the heat storage type, not exceeding 3 kW each, the Council reserving the right to cut off the supply between the hours of 4 and 6 p.m. daily.

Lytham-St. Annes.—Electricity Supply.—The Town Council has conferred with the Blackpool Corporation with reference to terms for a bulk supply of electricity from Blackpool. Mr. J. H. Clothier, the electrical engineer of St. Annes, has prepared a report on the question of supplying the old portion of Lytham with current, and in anticipation of making a start as soon as possible, he has invited tenders for the cables. It has been decided to seek sanction to the borrowing of £75,000 for the purposes of the electricity undertaking.

Electricity Charges.—The minimum charge for electricity has been considered by the Council, and it has been decided that in cases where electricity consumers have both light and power meters, the one minimum charge should apply, instead of two separate charges as at present.

Manchester.—Barton Power Station.—The Corporation's power station at Barton will be officially opened next October. Three 27,500-kW sets, each with a maximum output of 31,250 kW for short periods, are to be installed. Provision has been made for the accommodation of plant with a capacity of 150,000 kW. The station will cover an area of 14½ acres.

Hire of Domestic Appliances.—The Electricity Committee proposes to hire out electric cookers and other domestic appliances, and has recomended that a quarterly charge be made for their use.

Market Harborough.—Electricity Supply.—The Urban Council has completed a canvass in connection with a supply of electricity from Kettering. The Kettering Counctil asked for a guarantee of 100 consumers, and the canvass has shown over 200, and steps are to be taken to obtain an Order to enable electricity to be supplied to supplied to the town.

Mold.—Special Order.—The Electricity Commissioners have granted a Special Order to the Urban Council authorising it to supply electricity within the district.

Price Reductions.—Reductions in the charges for electricity have been made in the following districts:—

Bedford.—Lighting, a reduction of 1d. per kWh, less 2½ per cent., for prompt payment of accounts; heating and cooking, first 200 kWh per quarter, 1½d. per kWh, next 500 kWh, 1½d. per kWh, beyond that amount, 1d. per kWh, less 2½ per cent.; kinemas, 3½d. per kWh, less 2½ per cent.

Colchester.—Lighting, by 1d. per kWh; power by ½d. per kWh; and traction supply by ½d. per kWh.

Heston and Isleworth.—Lighting, ordinary meters, 6½d. per kWh; prepayment meters, including meter rent, 8d. per kWh; power, heating and cooking, for the first 1,000 kWh per quarter, 2½d. per kWh, next 10,000, 2½d. per kWh, next 15,000, 1½d. per kWh, and for all energy in excess of this amount, 1½d. per kWh.

Middleton.—Lighting, 6½d. per kWh; domestic purposes, 2d. per kWh. The minimum charge has been reduced from £2 to £1 10s.

Stockton.—Electricity for all purposes has been reduced in price by 10 per cent.

Winchester.—Lighting, flat rate, 7½d. per kWh, maximum demand rate, 9½d., 5½d., and 2½d. per kWh; power, flat rate, 4d. per kWh; maximum demand rate, 5½d., 2½d., and 1½d. per kWh; heating and cooking, 1½d. per kWh.

Wrexham.—Lighting, 7½d. per kWh for the first 1,000 kWh and 6½d. per kWh beyond; rateable value scale for private houses, 20 per cent., plus 1½d. per kWh for lighting, heating, and cooking. Slot meters, 8d. per kWh net; power and heating, 3d. per kWh for the first 1,000 kWh; next 1,500 kWh, a reduction of 2½ per cent.; next 2,500 kWh, a reduction of 5 per cent.; next 5,000 kWh, a reduction of 10 per cent.; next 5,000 kWh, a reduction of 20 per cent.; for all energy beyond this amount a reduction of 33⅓ per cent.

Salford.—Change of System.—The Electricity Commissioners have sanctioned the changing of the system of supply in a portion of Higher Broughton from direct current, at 220 and 440 V, to alternating current at a frequency of 50 cycles and at the same pressures.

Loan.—Application is being made to the Electricity Commissioners for sanction to a loan of £3,500 for the provision of l.p. distributors.

Sunbury.—Electricity Supply.—The Urban Council has approved the application of the Egham and Staines Electricity Co., Ltd., for a Special Order to extend its area, so as to include Feltham, Sunbury, Shepperton, and Littleton.

Sutton-in-Makerfield. — Electricity Supply.—The Urban District Council has under consideration applications from the Derbyshire and Notts. Power Co. and the Mansfield Town Council for approval of an Order to supply electricity to the district, and has decided to obtain the advice of its Parliamentary agents.

Tillicoultry (Clackmannan).—Electricity Supply.—The Town Council has appointed a committee to prepare a report on an electricity scheme for the borough.

Tredegar.—Electricity Supply.—The Electricity Commissioners have advised the Urban Council to ascertain from the South Wales Electrical Power Distribution Co. its terms for supplying electricity in bulk, and the Council has adopted this course.

Tunbridge Wells.—New Plant.—The borough electrical engineer has submitted to the Town Council proposals for the extension of the plant at the power station. He suggests that the system should be changed from 2,000-V single-phase, 67.5 cycles to 6,600-V, single-phase, 50 cycles. The change would necessitate the installation of two 1,500-kW turbo-alternators at a cost of £22,825, three water-tube boilers and economisers at a cost of £13,215, and other plant, bringing the total cost of the extensions to £56,943. The matter is to be brought forward at the next meeting of the Lighting Committee.

Ulverston.—Electricity Scheme.—Upon the advice of Mr. C. H. Wordingham, C.B.E., the Urban District Council has decided to enter into an agreement with the Barrow Corporation for the bulk supply of electricity, which the Urban District Council will distribute. Mr. Wordingham dismissed a suggestion that the Council should erect its own station on the ground of excessive cost. The cost of erecting a h.p. transmission line is estimated at £11,033, and the cost of a distribution network at £5,290. An average charge of 7½d. per kWh is suggested.

United States.—Niagara Falls Scheme.—The new hydraulic pressure tunnel of the Niagara Falls Power Co., completed at a cost of $2,500,000, was opened for public inspection on March 26th. The great tube, which is 4,300 ft. long and has a diameter of 32 ft. within its two-foot concrete wall, runs from an intake on the upper river, half a mile above the falls, to another intake on the banks of the lower gorge. The tunnel will carry a volume of water sufficient to feed three slope tunnel penstocks and operate three generating sets, each of 70,000-h.p. capacity, in the power house below the gorge bank. Construction was started on April 25th, 1921, under a licence given to the company by the Federal Power Commission to divert 19,500 cu. ft. per sec. of water from the Niagara River for the development of power. Water will be turned into the tube within a few weeks.—*Reuter's Trade Service* (Niagara Falls, N.Y.).

High-voltage Transmission.—The Detroit Edison Company, which supplies power to a number of electric railways in and around Detroit, is making a notable change in its power transmission system. The company proposes to establish a 120,000-V transmission system around the territory in which it serves power. It is intended to tie the new 120,000-V ring into the present 24,000-V system at several points. The power at one of the existing power plants will be transformed from 12,000 to 120,000 V in a bank of three single-phase transformers; it will be transmitted at the high voltage about 60 miles and then stepped down to 24,000 V and tied in with the lower voltage system through a bank of three single-phase transformers. At an intermediate point the high-pressure line will be tied to the 24,000-V system through a third bank of transformers.—*Electric Railway Journal.*

A Large Pulverised Fuel Station.—The *Electrical World* states that the new Trenton Channel station which is being erected by the same company is to utilise powdered fuel. The new station will contain an initial installation of six "Type W" Stirling boilers of about 2,900 h.p. rating.

Wolverhampton.—Special Order.—The Town Council is applying to the Electricity Commissioners for a Special Order for the purpose of extending the area of supply so as to include certain parishes and townships in the rural districts of Cannock and Seisdon.

Worthing.—New Plant.—Acting on a report from its electrical engineer (Mr. G. Porter), the Town Council has approved the proposed extensions to the generating plant. A heavy oil engine and dynamo of 750-kW capacity is to be installed at an estimated cost of £18,000, extensions to the power station buildings are to be carried out at an estimated cost of £9,000, and 12,000 yd. of distributing mains renewed at a cost of £4,450. The extensions will suffice for the next ten years. Application is to be made to the Electricity Commissioners for sanction to the borrowing of £18,000 for the oil engine and dynamo.

TRAMWAY AND RAILWAY NOTES.

Argentina.—Buenos Aires Tramway Fares.—The Municipal Council of Buenos Aires has under consideration the reduction of the fares charged by the Anglo-Argentine Tramways Co., Ltd. The present rate of 12 cents was increased from 10 cents in 1920, for a three-year period, to enable the company to secure a fair return on its capital. It is stated that costs have fallen sufficiently to justify a reversion to the former rate, but the company does not agree that this is the case.

Australia.—Melbourne (Vic.).—The chairman of the Melbourne Tramways Board recently stated that developments involving the expenditure of over £8,000,000 were contem-

plated between the present time and 1941. There would be constructed 83 miles of new double track and 51 miles of single track, and the sum named would include the electrification of the cable system.

Newcastle (N.S.W.).—The traffic manager of the tramways states that already £500,000 has been spent on the electrification of the system. The power station has been practically completed and sites have been acquired for two sub-stations.

Belgian Congo.—Proposed Railway Electrification.—A Bill has been passed by the Belgian Senate whereby the Belgian Colonial Government will place a sum of 100,000,000 fr. at the disposal of the Congo Railway Co. for the reconstruction of the line between Leopoldville and Matadi. A plan is also afoot for the electrification of this line.—*Reuter* (Brussels).

Blackpool.—New Cars.—The Town Council is applying to the Ministry of Transport for sanction to the borrowing of £14,000 for four new tramcars, and the reconstruction of four old cars.

Bolton.—New Route.—The Tramways Committee proposes to construct a tramway track to Westhoughton.

Continental.—Czecho-Slovakia.—Work is to be commenced on the electrification of the railway from Prague to Pilsen, which will be completed in 1926. If this scheme is successful other branches of the State railways will be electrified.

Hull.—New Route.—The Tramways Committee has decided to extend its line along Holderness Road to Sutton Lane End.

London.—Traffic Return.—The L.C.C. announces that during the past year 726,000,000 passengers were carried on the tramway system, an increase of 36,000,000.

Cheap Fares.—The London & North-Eastern Railway has arranged with the District and Central London Railways to issue cheap one-day and week-end excursion tickets to Southend-on-Sea.

New Ticket Machine.—The London Electric Railway Co. has installed a return-ticket slot machine at Golder's Green station, which will supply return tickets to a number of stations. If this experiment proves successful, similar machines will be installed at other terminal stations.

Wolverhampton.—Railless Cars.—The Tramways Committee proposes to remove the tramway track on the Wednesfield route and to substitute a railless-car system at an estimated cost of £15,328.

TELEGRAPH & TELEPHONE NOTES.

Finland.—Telephonic Communication.—The Government has authorised the Telegraph Board to send a representative to Berlin to negotiate with representatives of Sweden and Germany regarding the proposal to establish a telephone service between Finland and Germany *via* Sweden. — *Reuter* (Helsingfors).

RADIO-TELEGRAPHY AND TELEPHONY.

Germany.—Broadcasting.—After four months of experimenting, the Express Service Co. (Eildienst Gesellschaft m.b.H.), Berlin, began on January 1st a daily service of financial and commercial news broadcasting. This company is financed by German capital and is purely a private undertaking. Under agreement with the National Government for the use of the radio station at Koenigswusterhausen on a limited basis for a definite period, a regular service of financial news received from the United States, Switzerland, Sweden, and other countries, *via* the station at Nauen, is broadcast immediately by radiotelephone to subscribers of the company, who number at present about 800, mostly banks and industrial institutions located in some 200 towns and cities. It is expected that New York quotations handled by this service will be available generally to subscribers within 10 minutes of their dispatch from New York. Each subscriber rents from the company the necessary receiving apparatus, paying for the service itself an annual fee of 300,000 marks and for the apparatus an annual rental of approximately 200,000 marks. There are two half-hour schedules daily, at 9.30 a.m. and at 5 p.m.—*Commerce Reports.*

New Zealand.—Broadcasting.—The New Zealand Government has adopted regulations for amateur experimental and broadcasting stations throughout the Dominion, which has been divided into four radio districts—Canterbury, Otago, Auckland, and Wellington. Provision has been made for licences to establish radio stations, also for certificates for operators, evidence of British nationality being required from both licensees and operators. Special precautions have been taken to prevent interference with ships' messages and especially S.O.S. calls. One of the regulations forbids the broadcasting of controversial propaganda.

Norway.—Broadcasting.—The Norwegian Telegraph Administration recently made public the basis for negotiations with foreign companies applying for broadcasting licences in Norway. The company to which a licence for broadcasting is to be issued must be a stock company in which only Norwegian capital is represented and in which Norwegian radio manufacturers, Norwegian Press, and local amusement syndicates must have an interest. The Telegraph Administration will place the Christiania radio station at the disposal of the broadcasting company for experimental purposes and for the erection of any apparatus needed for broadcasting. This additional apparatus must be supplied by the company at its own expense. The Administration will provide the operating personnel and bear the cost of maintenance, including the power required. To cover the cost of overhead and operating expenditure the company will pay the Administration a fixed monthly sum.

Broadcasting is to be limited to a few hours in the evening. At all other times the Telegraph Administration is to have exclusive use of the station. All material to be broadcast must be censored by the Telegraph Administration. The term of the concession will be limited to two years pending future legislation. Licences for receiving apparatus will be issued only to those buying or renting apparatus of Norwegian manufacture, approved by the Telegraph Administration. The company is not to have a monopoly of the manufacture of apparatus, but may require remuneration for broadcasting. Foreign manufacturers will have the right to make an agreement with the broadcasting company. The company will pay a definite fee to the Telegraph Administration for every receiving set sold or rented.—*Commerce Reports.*

Russia.—Production of Radio Apparatus.—Hitherto all wireless apparatus used in Russia has of necessity had to be imported from abroad. Now, however, the Petrograd works of the Weak Current Trust have commenced the production of radio apparatus, and the first Russian-made ship installation is reported to have yielded better results than had been expected.

Ships' Radio Apparatus.—Use in Harbours.—The General Post Office authorities have decided to raise no objection to a ship using its radio apparatus in the harbours and estuaries in the United Kingdom. The permission, however, does not apply to naval harbours or the Port of London above Barking Reach. Messages must be of an urgent business nature, and must be exchanged with the nearest Post Office coast station. Only a minimum power may be used, in order to prevent interference with other traffic, and the messages must stop whenever a request is received from a Government or commercial station.—*Evening News.*

Sweden.—Broadcasting.—Application has been made by the Berlin A.E.G. company and two Swedish companies to the Swedish Government for a concession for the monopoly of radio concerts in Sweden. Should the concession be granted, it is intended to form a company with a capital of 1,000,000 krona.

United States. — Hotel's Innovation.—"Listening-in" enthusiasts are being especially catered for by the management of one of the large hotels at Minneapolis, which has concluded contracts for fitting plugs in several hundred rooms for the attachment of radio receiving apparatus. An aerial and three receiving stations will be equipped on one of the top floors of the hotel, and each room will have a plug connected to one of the three receiving sets. Successful experiments were carried out recently, when occupants of more than a hundred rooms listened to a radio concert.—*Reuter.*

Prominent banking and motor trade interests have purchased the control of the De Forest Radio Telephone and Telegraph Co., says the *Financial Times.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Amble.—May 1st. Urban District Council. Pole line, transformers and switchgear. (See this issue.)

Australia. — Brisbane.—May 11th. Postmaster-General's Department. Cable terminal boxes.*

Sydney.—June 13th. New South Wales Railways. Two 20,000-kW turbo-alternators for the White Bay power house. Chief electrical engineer, 61, Hunter Street, Sydney.

Belfast.—April 21st. Tramways Committee. Reconstruction of about 11¼ miles of single track. (See this issue.)

Belgium.—Municipal authorities of Villers-L'Eveque. For the concession for the supply of electrical energy in the town.

April 20th. Municipal authorities of Uyckhoven (Province of Limbourg). For the establishment of a l.p. electricity distribution system in the town.

Bradford.—Corporation Electricity Department recommends that tenders be invited for one 1,200/1,600-kW turbo-alternator, condensing plant and auxiliaries, additions to the e.h.p. switchgear, four cooling towers, and alterations to existing towers.

Blackpool.—The Corporation tramway manager has been authorised to obtain tenders for four new tramcars.

Buxton.—April 21st. Electricity Department. Storage battery, automatic reversible booster plant with exciters and switchgear. (April 6th.)

Carlisle.—April 23rd. Electricity Department. H.p. and l.p. paper-insulated lead-covered cables. (April 6th.)
April 25th. Electricity Department. One water-tube boiler. (See this issue.)

Conway.—April 20th. Board of Guardians. Electric lighting installation at the Union offices and institution. Clerk to Board of Guardians.

Edinburgh.—April 16th. Electricity Supply Department. 6,600-V and 33,000-V switchgear, two induction motors, and 33,000-volt overhead main transmission line. (March 30th.)
Electricity meters for twelve months. (April 6th.)
April 23rd. Electricity Supply Department. One 250-kVA, 3-phase transformer and 6,600-V, e.h.p. switchgear. (See this issue.)

Glasgow.—April 30th. Electricity Department. Cables, meters and carbons for 12 months. (See this issue.)

Grimsby.—April 28th. Electricity Department. Substation 6,000/6,600-V switchgear and five transformers, with capacities up to 100 kVA. (See this issue.)

Kingston-upon-Hull.—City and County Telephone Committee. Table telephone instruments, rubber-covered wire, and dry cells. (See this issue.)

Kirkcaldy.—May 1st. Electricity works. H. and l.p. feeder cables and cooling tower. (See this issue.)

London. — Metropolitan Asylums Board.—April 25th. Electric lighting installation in the staff blocks, &c., at the Grove Fever Hospital, Tooting, S.W. (See this issue.)

Lytham-St. Annes.—April 26th. Electricity Department. E.h.p. cables. (See this issue.)

New Zealand.—Wellington.—May 22nd. Post and Telegraph Department. Wall and desk C.B. telephones.*
June 12th. Public Works Department. Electric storage battery and accessories.*

Preston.—Electricity Committee. Two 500-kW rotary converters, with transformers and switchgear. E.h.p. and l.p. paper-insulated cable. Borough electrical engineer, 118, Fishergate, Preston.

Reigate.—April 30th. Electricity Department. Transformers and switchgear. (See this issue.)

Rochdale.—April 23rd. Board of Guardians. Electric lighting and telephone installation at the Union offices. Mr. R. A. Leach, Union Clerk, Union Offices, Townhead, Rochdale.

Scunthorpe.—April 18th. Scunthorpe and Frodingham Urban District Council. Electric recorders, telephones, lighting plant, and wiring required in connection with waterworks extensions. Mr. A. M. Cobbam, engineer, Council Offices, Scunthorpe.

South Africa.—Cape Town.—May 7th. 5,000 25-amp. iron-clad service cut-outs.*

Southport.—April 24th. Town Council. Relaying 1,738 yd. of single tramway track in Mornington Road, Derby Road, and Sussex Road. Mr. A. E. Jackson, borough engineer, Town Hall, Southport.

Stoke-on-Trent.—March 16th. Electricity Department. One 5,000-kW turbo-alternator and condensing plant. (April 6th.)

Sweden.—Norrkoping.—Harbour Board. Three 4-ton and one 5 to 6-ton electric cranes. Particulars from the British Vice-Consul, Norrköping.*

Taunton.—April 26th. Electricity Department. One water-tube boiler. (See this issue.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

CLOSED.

Australia.—Melbourne.—Victorian Electricity Commission. Accepted:—
Coal-handling plant (£63,274).—Gibson Battle, Ltd.
Feed-water evaporators (£10,371).—Government Dockyards, New South Wales.
Steam boiler feed pumps (£5,500).—Ferrier Dickinson, Ltd., Sydney.—*Reuter's Trade Service* (Melbourne).

Bradford.—Tramways Committee.
Wood-refuse collecting plant for Thornbury tramway workshops (£295).—Rowbothams (Ventilating Engineers), Ltd.
Plant for use at Thornbury tramways workshops for cleansing used cotton waste (£173).—Industrial Waste Eliminators, Ltd.
Four miles of round copper trolley wire (£460).—Collier Bros.

Belgium.—The Belgian Post and Telegraph authorities in Brussels have just divided some large contracts for miscellaneous telephone material between the New Antwerp Telephone and Electrical Works, of Berchem, Antwerp, E. Gerard & Fils, of Liége, and C. Richez, of Brussels.

There was keen competition last week for the contract for the supply to the municipal authorities of Schaerbeek of 100 electricity meters for power and lighting and 600 single-phase meters, the lowest tender being that of the Société Industrielle de Matériel Electrique, of Brussels.

The Société des Ateliers de Constructions Electriques de Charleroi, last week submitted the lowest tender to the Belgian Post and Telegraph authorities in Brussels for telephone cable, the only other competitors being the Bratislava Cable Works and the Lyons Cable Works.

Cardiff.—Electric Lighting Committee.
Two economisers (£3,236).—E. Green & Sons.
Overhead steel bunkers and boiler-house roof (£3,000).—Sir Wm. Arrol and Co., Ltd.
5,750-g.p.m. pump (£398).—Rees Roturbo Manufacturing Co., Ltd.
E.h.p. switchgear (£1,081).—Ferguson, Pailin, Ltd.
10,500 yd. of cable (£790).—British Insulated & Helsby Cables, Ltd.
Twelve months' supply of cable (£7,916).—British Insulated & Helsby Cables, Ltd.

Edinburgh.—Tramways Committee.
For supply of 24 air-brake equipments (£3,226).—British Air Brake Co., Ltd. (Recommended.)

The City Council has decided to refer the matter to a sub-committee, with power to obtain expert advice.

Essex.—County Council. Accepted:—
Installing electric lighting at Black Notley Sanatorium (£511).—E. Beckwith & Co., of Barking.

London.—Metropolitan Asylums Board.
X-ray apparatus at Goldie Leigh Homes:—

Newton & Wright, Ltd. (recommended)	**£192**
X-rays, Ltd.	195
F. Butt & Co., Ltd.	208

Hackney.—Electricity Committee.
Plant for Dalston Lane sub-station:—
One 1,500-kW Peebles-La Cour converting set (£5,615).—Bruce Peebles and Co., Ltd. (Recommended.)
Completion of the necessary e.h.p. and l.p. switchgear for two 1,500-kW rotary converters, three e.h.p. feeders, and three l.p. feeders (£4,263).—Johnson & Phillips, Ltd. (Recommended.)

Underground Electric Railways Co. of London.—The company has just placed two further contracts for escalators, *viz.*:—The Foundation Co., Ltd., for escalators at Moorgate Street (£42,574); J. Cochrane & Sons, for escalators at Shepherd's Bush (£21,709). The escalators at Moorgate Street are to be completed in nine months' time and at Shepherd's Bush in seven months' time.

Manchester.—Electricity Committee. Accepted:—
D.c. meters.—Ferranti, Ltd.; Chamberlain & Hookham, Ltd.; Aron Electricity Meter, Ltd.
A.c. meters.—Ferranti, Ltd.; Metropolitan-Vickers Electrical Co., Ltd.
Potential transformers and current transformers.—Ferranti, Ltd.
Time switches.—Venner Time Switches, Ltd.
Circuit breakers.—Park Royal Engineering Works, Ltd.; British Thomson-Houston Co., Ltd.
Knife switches.—Park Royal Engineering Works, Ltd.; Ferguson, Pailin, Ltd.
Ammeters.—Bertram Thomas.
Cable.—Callender's Cable and Construction Co., Ltd.; British Insulated and Helsby Cables, Ltd.; Macintosh Cable Co., Ltd.; Pirelli-General Cable Works, Ltd.; W. T. Glover & Co., Ltd.

Newport.—The Corporation has this week resolved to duplicate the orders for boilers recently placed with the Spearing Boiler Co., further extensions having been agreed to.

Preston.—Corporation. Accepted:—
One year's supply of "Utility" current limiters.—Electrical Utilities, Ltd.

Rotherham.—Town Council. Accepted:—
300 tons of steel tramway rails at £14 per ton.—Steel, Peech & Tozer.
Points and crossings (£595).—Hadfields, Ltd.

Salford.—Education Committee. Accepted:—
Installation of electric lighting at the Grecian Street boys' school (£240).—County Electrical Co.
Alterations to electric lighting installation at Leicester Road mixed and Grecian Street girls' schools.—W. Anderton & Co., Ltd.

Tramways Committee. Accepted:—
Miscellaneous stores:—
Electric lamps.—Drake & Gorham Wholesale, Ltd.; British Insulated and Helsby Cables, Ltd.
Gears.—Metropolitan-Vickers Electrical Co., Ltd..
Steel tires.—Brown, Bayley's Steel Works, Ltd.
Gears and pinions.—British Hele-Shaw Patent Clutch Co., Ltd.
Trolley heads and wheels.—Kay & Co., Ltd.; G. Wallsop.
Brake blocks.—National Railway and Tramway Appliances Co., Ltd.
Special tramway track for the junction of Bury New Road and Great Cheetham Street (£1,875).—Hadfields, Ltd.
Five low-type tramcars (£9,200).—Brush Electrical Engineering Co., Ltd.

Electricity Committee. Accepted:—
L.p. electricity supply mains (£4,046).—W. T. Glover & Co., Ltd.

Wolverhampton.—Town Council. Accepted:—
7,500-kW turbo-alternator, with air- and oil-cooling plant (£19,565).—British Thomson-Houston Co., Ltd.

Worthing.—With further reference to the note on page 541 of the Electrical Review of April 6th, the following is the list of tenders received for the supply of cables:—

Enfield Ediswan Cable Works, Ltd. (recommended) ...	**£3,482**
Electrical Supplies Co., Ltd.	3,315
Nederlandsche Kabelfabriek	3,405
Hackbridge Cable Co., Ltd.	3,478
Callender's Cable and Construction Co., Ltd.	3,689
Pirelli-General Cable Works, Ltd.	3,729
W. T. Henley's Telegraph Works Co., Ltd.	3,730
Siemens Bros. & Co., Ltd.	3,736
British Insulated and Helsby Cables, Ltd.	3,737
Johnson & Phillips, Ltd.	3,743
W. T. Glover & Co., Ltd.	3,752
Western Electric Co., Ltd.	3,767
Union Cable Co., Ltd.	3,773
Nordiske Kabel-Og Traadfabriker	3,825
Watshams	3,841
Hulburn & Co.	4,051
Macintosh Cable Co., Ltd.	4,179

Winchester.—Town Council. Accepted:—
Battery.—Tudor Accumulator Co., Ltd.
Booster.—Electric Construction Co., Ltd.
Boiler feed pump.—Mather & Platt, Ltd.
Cables.—Enfield-Ediswan Cable Works, Ltd.

FORTHCOMING EVENTS.

Birmingham and District Electric Club.—Saturday, April 14th. At the Grand Hotel, Colmore Row. At 7 p.m. Paper on "Engines for Small Electric Generating Plants," by Mr. E. Cauldwell.

Royal Society of Arts.—Monday, April 16th. At John Street, Adelphi, W.C. At 8 p.m. Cantor lecture, "Nitrates from the Air," by Mr. E. Kilburn Scott.

Institution of Electrical Engineers (Sheffield Sub-Centre).—Tuesday, April 17th. At the Royal Victoria Hotel, Sheffield. At 8 p.m. Address by the President, Mr. F. Gill, and smoking concert.

(Mersey and North Wales—Liverpool—Centre).—Monday, April 16th. At the University, Liverpool. At 7 p.m. Paper on "The Drive of Power Station Auxiliaries," by Mr. L. Breach and Mr. W. Midgley.

Liverpool Engineering Society.—Wednesday, April 18th. At the Royal Institution, Colquitt Street. At 8 p.m. Paper on "The Rating of Machinery," by Mr. E. W. Pierce.

Chemical Society.—Thursday, April 19th. At Burlington House, W. At 8 p.m. Ordinary Scientific Meeting.

Royal Institution of Great Britain.—Thursday, April 19th. At Albemarle Street, W. At 3 p.m. Lecture on "Transmission of Speech by Light," by Prof. A. O. Rankine. (Lecture II).

Junior Institution of Engineers.—Friday, April 20th. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette, "The Business of Engineering," by Mr. H. N. Munro.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

We have to remind readers that Service Department inquiries should be accompanied by a stamped envelope.

The makers or suppliers of the following devices are asked for:—

Electrical motion signs for shop windows which do not depend upon electric light for effect.

Cheap composition for moulded insulation giving appearance of ebonite.

A spring push-type terminal for small cables (replacing screws).

Kierpite insulation.

Moulds for accumulator plates.

NOTES.

An English Electric Aeroplane.—Tests began at Ashton Park, Preston, on April 5th, of the first British auxiliary-engined glider, the "Wren," designed and built by the English Electric Co., at Preston. It is expected that the machine will provide valuable data for the development of economical aeroplanes. It is stated that machines of this type will cost about £250 each, and under real mass production about £150.

Key and Keyway Standardisation.—The Sub-Committee of the British Engineering Standards Association, engaged in revising standard specification No. 46 (Keys and Keyways), and enlarging it to cover other forms of keys, has found itself faced with the fact that key and keyway nomenclature appears to vary in different parts of the country; consequently it has been studying this question with the object of bringing about uniformity. Suggested nomenclature has been prepared and comment or criticism is invited for the assistance of the sub-committee.

Industrial Paints.—The report of the Departmental Committee on Industrial Paints, which has just been issued H.M.S.O., 2s. 6d. net), completely reverses the recommendations of a committee which, in 1915, advised the prohibition of the use of white lead for painting buildings, being of opinion that regulations to prevent the risk to the health of painters using lead paints could not be made effective and that leadless paints could take the place of lead paints.

The committee is satisfied that for outside painting, and for certain kinds of internal painting, there is at present no efficient substitute for lead paint.

The statistics given in the report show that while sufficient to justify legislative action, the cases of lead sickness among painters compare well with those in other lead-using industries; the attack rate per 1,000 being, for instance, 27 for the electrical accumulator industry, while for the painting industry, the figures are indicated as being, in 1914, 4.5, and in 1921, only 0.28.

The "Short-Circuit Beetle."—Beetles which bore through lead cables, but which, nevertheless, do not or cannot penetrate pure gum rubber, have proved a serious problem and pest in California and many other parts of the United States. One of the most important injuries inflicted by these beetles is the damage done to the lead sheathing of telephone cables in California. The beetles bore circular holes in the sheathing, about one-tenth inch in diameter. Moisture enters the cable through these holes, causing a short-circuiting of the wires and interruption of service to the public. As one hole may put from fifty to six hundred or more telephones out of use for from one to ten days, the damage is rather extensive.

Experiments have been undertaken at various times by the Bureau of Entomology of the United States Department of Agriculture to determine what treatment could be used to keep the beetles from injuring the cables. These experiments are summarised in a professional paper, issued as Department Bulletin 1107, "The Lead-Cable Borer in California," by Messrs. R. D. Hartman, H. E. Burke and T. E. Snyder, entomologists. The results indicate that the beetle is able to penetrate any lead alloy used as a cable sheathing or any poison or repellant placed on it. Probably it is able to penetrate the poisons because it does not feed as it bores through. Beef tallow, when sufficiently soft, will stick to the beetle and suffocate it, and has been used with some success on the rings which suspend the cable, since practically all the boring is done near the rings. Layers of friction tape impede the boring and thin sheets of copper, zinc and steel prevent it. Sleeves of these metals can be placed around the cable at the rings, but the cost would probably be too great for general use. A new type of ring made of flattened steel-wire stock and galvanised is now being installed by the telephone companies, and it is believed that this ring is better from the standpoint of preventing attack by the beetle than the old one. Meanwhile, tallowing the rings is the most promising method of control.—*Science.*

Appointments Vacant. — Draughtsmen, for the Air Ministry; mains assistant, for the Wolverhampton Corporation electricity department; control engineer, for the Yorkshire Electric Power Co.; superintendent of street and public lighting (£400), for the Leicester Corporation; charge engineer (£6 15s.), for the Belfast Corporation electricity department. (See our advertisement pages to-day.)

The Association of Engineers-in-Charge. — Annual Dinner.—On Saturday last the annual dinner of this Association was held at the Holborn Restaurant; Dr. H. S. Hele-Shaw, F.R.S. (president), occupied the chair, with Mr. W. McLaren (chairman) in the vice-chair, and there was a large attendance, including many distinguished guests. Amongst the latter were Mr. W. H. Patchell, Capt. H. Riall Sankey, C.B., Mr. T. Cooper, Mr. H. Baines, C.B.E., Brig.-Gen. Magnus Mowatt, C.B.E., Eng. Vice-Admiral Sir George G. Goodwin, K.C.B., Mr. E. A. Sandford Fawcett, C.B., Mr. F. Gill, and Mr. W. C. Clifford Smith, O.B.E.

After the loyal toasts, Capt. H. R. Sankey proposed "Research and Practice," pointing out that the whole of the electrical industry was founded on the results of pure scientific research. Research was also usefully directed towards the improvement of efficiency and economy, *e.g.*, in the manufacture of steel; as the result of an investigation into aluminium alloys, a new research on steel was being commenced which would cost £5,000, and would be jointly undertaken by the Royal Society and the leading Institutions. He thought the Joint Engineering Council should supervise research; the Council would exercise great influence over the future of engineering, and set it before the public in its true light. Responding, Mr. F. Gill (President, I.E.E.), who also referred to the magnificent work that the Joint Engineering Council could do, described the phenomenal progress effected in the development of telephony within the last 21 years by the agency of research; as the result of four new developments, the saving to-day was more than ten million pounds a year. The fact that progress depended on the amount of money put into research was not properly realised in this country; it was hard to set a limit to the profits on such an investment. Individual engineers could succeed only by keeping in touch with the results of research, and he strongly recommended his hearers to do this.

Eng. Vice-Admiral Sir George Goodwin, proposing "The Association," claimed that he himself had been an engineer-in-charge; when he was in charge of a Naval dockyard, he had noticed the enormous benefits derived from the interchange of personal experiences, which could be effected not only by reading papers, but also by conversation and by printing short practical notes in a society's journal. Prof. Hele-Shaw, responding, said the Association had now recovered from the great set-back due to the war; the meetings were better attended and the membership was greater than ever before, and the Association was on the verge of becoming incorporated. The social gatherings and informal discussions were of the greatest value to the members.

"Our Guests and Friends" was proposed in a spirited speech by Capt. H. J. Wellingham, M.C., and, in responding, Mr. H. Baines, C.B.E. (chief engineer, H.M.O.W.), explained how, by segregating the maintenance service from new construction, he had saved £100,000 in the first year and reduced the staff by 600 men. Accurate costing was most important, and he had started a costing department which enabled comparisons to be made between the various districts; a system of collating information from all sources had been inaugurated.

Mr. W. McLaren proposed "Our President" in highly appreciative terms, and Capt. A. E. Penn cordially supported the toast. In his reply, the President paid a handsome tribute to the splendid work done by the committee, and particularly that of the indefatigable honorary secretary, Capt. Penn. A programme of music was performed during the meal, which was followed by an excellent musical entertainment interspersed with the toasts.

The Greenawalt Electrolytic Copper Extraction Process.—Mr. W. E. Greenawalt claims that a process for the electrolytic deposition of copper from acid solutions which he has devised reduces the amount of ferric salts, which make the deposition of copper highly inefficient. Several methods have been tried or proposed to accomplish this previously. The interposition of a diaphragm between the electrodes, so as to prevent the ferric salts formed at the anode from getting to the cathode, has been suggested. Other methods are the precipitation of the iron out of the solution before electrolysis, or the diversion of a portion of the copper solution at each cycle, so as to maintain the iron salts at as small a percentage as possible, and precipitating the diverted portion usually with scrap iron. It is also possible to render the ferric salts harmless, or even useful, by effectively reducing them to the ferrous condition. The Greenawalt process consists in reducing the ferric salts formed by electrolysis by sulphur dioxide, copper sulphide, and the two combined. The arrangement comprises a set of sulphur-dioxide reducers, groups of copper depositing cells, and a flow of solution, arranged so that there is a regulated stream of reduced solution from the reducers to the corresponding cells, and of electrolysed solution from the cells to the corresponding reducers, in a sort of enclosed circuit, while at the same time there is a regular advance flow of a portion of the solution through the entire series of reducers and cells. The electrolysed solution, depleted in copper and re-generated in acid, is then returned to the ore for another cycle. It is stated that in this process carbon anodes may be substituted for lead anodes, which gives more effective depolarisation and a consequent reduction in power consumption.

Broadcasting in the United States.—The report for 1922 of the Radio Corporation of America, which controls the Marconi interests in the United States, shows the extraordinary zest with which broadcasting has been taken up in that country. According to the *Financial Times*, the gross income of the corporation has jumped from $4,160,800 to $14,830,900. The ordinary services exhibit quite a satisfactory expansion, income from transoceanic communication having risen from $2,138,600 to $2,914,300, or 36 per cent., and from the marine branch from $533,300 to $630,100, or 14 per cent.

In contrast to this, however, gross sales advanced from $1,468,900 to $11,286,500, this phenomenal leap being entirely explained by the demand for wireless telephone receiving sets. The broadcasting stations were not established until the end of 1921, and prior to last year no receiving apparatus had been developed which lent itself to quantity output. With the advent of the broadcasting stations, the corporation's technical staff concentrated on the production of radio receiving apparatus embodying the latest improvements, and of a character suited for general use, and their efforts were so successful that the demand, which had sprung up almost in a night, was satisfactorily met. The extent of that success is shown in the striking increase in sales.

Though revenue has grown so enormously, the corporation has not yet reached the point of paying any dividend on either its preferred or common shares. Operating and administration expenses increased from $3,762,200 to $12,126,500, and after allowing for sundry credits the net income for the year was $2,974,600, as against $426,800. In 1921 the whole of the net income was placed to the reserve for amortisation of patents and was below the required level, and this time no less than $2,480,600 is devoted to the same purpose, partly to make up for the previous year's deficiency. Of the residue, $270,000 is set aside for Federal income tax, and $224,000 is utilised in writing down organisation expenses.

Fog Removal and Rain Making.—How fogs are being removed and how rain will be caused to fall by electrically charged sand was explained in a statement made by Professor Wilder D. Bancroft, of Cornell University, an authority on colloid chemistry, who with L. Francis Warren has been conducting experiments at McCook Field, near Dayton, Ohio. Clouds consist of drops of water too small to fall at an appreciable rate. Drops are kept from coalescing either by being charged electrically and therefore repelling each other, or by being covered with a film of condensed air acting like a gelatine capsule. Spraying with positively charged sand will cause negatively-charged drops to coalesce, and will also remove the film of absorbed air to some extent. The first is the principle involved in precipitating electrically-charged colloids, and the second occurs when the crystal detector is used in wireless. The large drops fall and carry down with them many of the finer drops, just as the coarser particles of butter fat in milk carry up many of the finer ones when cream rises.

The new process invented by Mr. Warren sprays electrically-charged sand from above, and consequently gets more results for the same expenditure of power the thicker the cloud. Experiments at McCook Field show that with 80 lb. of sand charged nominally to 15,000 volts, a cloud covering two square miles can be dissipated in less than ten minutes. Much better results are expected with sand charged to 30,000 volts, and a more efficient charging nozzle.

Experiments so far have been made in co-operation with the Army Air Service to demonstrate the feasibility of removing fogs from flying fields, as aviators can neither go up nor come down safely in fogs. Experiments to be made at Moundsville will use a captive balloon 1,000 ft. up to spray the sand and clear the field. Flying fields can certainly be kept clear, and the results look encouraging for clearing New York harbour when necessary. Successful preliminary experiments have been made with smokes; but nothing has been done with fogs containing smoke. The problem of removing London fogs seems much less visionary than it did one year ago, and is now a question of efficiency.

The Army Air Service is interested in fogs, not rain, and no experiments on rain-making have yet been made. The clouds attacked so far have contained very little moisture. The problem of obtaining rain from heavy clouds should be much easier than that of dispersing fogs. No claim is made that rain can be obtained from a clear sky. In many of the arid regions storm clouds pass over without raining; these can undoubtedly be made to rain. With a rain cloud one mile thick, the necessary expenditure of power will be the same as with a cloud 300 ft. thick, but the amount of rain will be very much greater. The problem of rain-making and of fog dispersal consists in making small drops into large drops by coalescence and is not a problem of condensation. Since a cloud is an unstable mass which should rain but does not, we are not dealing with gigantic forces of nature. The commercial success, if it comes, will be due to the fact that the development of the aeroplane has made it possible to attack clouds from above and to take advantage of the sweeping action of the falling drops. No one has ever considered rain-making as being colloid chemistry and not meteorology.—*Science*.

The South African Electricity Commission.—The Electricity Supply Commission under the Electricity Act of 1922 has now been appointed. Up to now its function has been exercised by the Board of Officials appointed as a separate body under the Act to supervise the issue of licences on the basis of the Transvaal Board appointed some 15 years ago.

The Board consists of Sir R. N. Kotze (chairman), Dr. H. J. Van der Byl (technical adviser), and Mr. Vaughan (inspector of machinery).

The new Commission has been constituted as follows: Dr. H. J. Van der Byl (permanent chairman), Mr. Robert Naven (of Johannesburg), and Mr. J. R. Foulton (retired railway engineer).

Among the first points to be considered by the Commission are: (1) The taking over from the S.A. Railways of the large power station in course of construction at Colenso. This station will serve primarily for the supply of energy to the railway between Maritzburg and Ladysmith, which is to be electrified; (2) the erection of a power station at Durban; (3) the provision of electrical power in the neighbourhood of the Sabie goldfields, Transvaal; and (4) the erection of a power station at Witbank.

New Electrical Indicator and Pressure Gauge.—Development of high-speed internal-combustion engines has been hindered by the lack of an indicator for accurate operation at speeds exceeding 1,400 r.p.m. Moreover, existing types of indicators are quite unsuited for use on aeroplane engines in flight. Two years ago experiments were initiated at the Royal Aircraft Establishment, which have resulted in the production of a very practical and valuable electrical indicator. Arising out of the research work on the indicator a guage to record maximum pressures and the variation thereof has been evolved. Although finality of design has not been attained, this type of indicator, on the bench, has met all requirements.

It will record with considerable sensitivity any cyclic change of pressure varying from, say, 4 to 1,000 lb. per sq. in. absolute, and give the average cyclic change of pressure over approximately 100 cycles on a time base.

The instrument used for recording maximum pressures is a simple adaptation of the principle employed in the indicator. The maximum pressure and variation of maximum pressure of any cycle can be recorded at all speeds likely to be met with in practice. The recording parts either of the indicator or the gauge may be placed remote from the engine under test, the qualification in the case of the former being the ability to get a drive from the engine. Both instruments are simple to operate and will give the desired record in ten seconds.

Both instruments are fully described by Mr. H. Wood, A.M.I.E.E., in the Aeronautical Research Committee's report No. 807 (E. 5).

The Electrical Engineers' Ball, 1923.—Those who took part in the Electrical Engineers' Ball on January 26th, and all others who desire the progress of electrical benevolence, will be interested to learn that the General Committee, at its last meeting, distributed the sum of sixty guineas to the Institution of Electrical Engineers' Benevolent Fund and sixty guineas to the Electrical Trades Benevolent Fund, out of the proceeds of the event.

INSTITUTION NOTES.

Institution of Electrical Engineers.—Informal Meeting.—At the next informal meeting of the Institution, on the 23rd inst., Mr. E. H. Shaughnessy, O.B.E., will open a discussion on "Practical Broadcasting."

North-Western Centre.—The annual general meeting of the North-Western Centre of the Institution was held on April 10th at Manchester, Mr. A. S. Barnard presiding. The com-

mittee's report stated that during the twenty-third session of the Centre ten meetings had been held, the attendance averaging 120 per meeting, as against 115 last year. A new departure was the inviting of ladies to participate in a general meeting when the subject "Electricity in the Home" was introduced by Mr. J. W. Beauchamp. The number of speakers in the discussions was 74; in this respect there had been a falling off, the number last year being 90, an average of nine per meeting. The membership had been reduced through the formation of the new Mersey and North Wales (Liverpool) Centre. It now stood as follows:—Members, 106; associate members, 406; associates, 13; graduates, 80; students, 360; total, 965. For the Liverpool Centre the figures on February 1st, 1923, were 53, 172, 5, 46, and 189; total 465. Including the Liverpool Sub-Centre the figures for 1921-22 were 1,343, and for 1920-21, 1,214. The increasing support given by the "small-current" or telegraphy members was noted with pleasure; the committee hoped to see a similar increase in the support given by other branches of the industry, such as railway and mining engineering. Thanks were voted to the chairman (Mr. Barnard) and the hon. secretary (Mr. Mallinson) for their services during the year. The election of officers for the next session resulted as follows:—

Chairman: Mr. G. A. Juhlin. *Vice-Chairmen*: Messrs. H. C. Lamb and A. G. Ellis. *Hon. Secretary*: Mr. A. B. Mallinson. *Committee*: Messrs. Carr, O'Brien, Watson, Sills, and W. R. Anderson.

After the meeting Dr. H. W. Nicholls's lecture upon "Trans-Oceanic Wireless Telephony" was read by Mr. R. A. Mack, and was followed by a short discussion.

North-Eastern Centre.—The annual meeting of the North-Eastern Centre was held at Newcastle-on-Tyne on April 9th, Mr. F. C. Baldwin in the chair.

The annual report of the Committee stated that 11 ordinary general meetings and one special general meeting had been held, and the average attendance showed an improvement on previous years. At the special general meeting held on February 26th the final by-laws for the Centre were approved, and, after confirmation by the Council, would be issued in printed form to members.

The membership of the Centre showed a slight increase over last session, the figures being: Members, 63; associate members, 211; associates, 7; graduates, 50; students, 189. The totals were 520 for the past year, and 503 for 1921-22. The Tees-side Sub-Centre membership was included in those figures, and was approximately 20 per cent. of the total.

The Students' Section was congratulated upon an excellent season's work. The Committee reported that it had co-opted as non-voting members a graduate, Mr. T. Sloan, and a student, Mr. W. N. Kilner, to represent the interests of their respective sections.

Mr. W. T. Maccall submitted the financial statement, showing that commencing the year with a credit balance of £87, they finished with £89.

The reports were formally adopted.

The election of officers resulted as follows:—*Chairman*: T. Carter. *Vice-Chairmen*: W. T. Maccall and R. W. Gregory. *Committee*: Power Supply Undertakings: A. G. Shearer, C. Vernier, J. M. Heslop, A. A. Hughes, H. Parry. Manufacturers and Contractors: W. Cross, B. A. Robinson, P. F. Allan, A. P. Pyne, G. G. Mallinson, W. D. Owen. Universities and Technical Colleges: F. H. Downie, W. T. Maccall. Municipal Engineers: W. T. Dalton. *Hon. Secretary*: H. B. Poynder. *Auditors*: C. Turnbull and J. Rosen.

The Chairman referred to the question of the provision of an engineers' club, and said that a good deal of time was spent a while ago going into the question with the Newcastle Society for the Chemical Industry, but nothing had come of it. Now they had received a letter from the Chemical Society stating that it had obtained very suitable rooms which, if members of the I.E.E. desired, could be secured. The Chairman added that as the season was so far advanced the Committee had left the matter in abeyance; but meanwhile individual members, who so desired, could become members of the club.

Mr. P. F. Allan referred to the Institution's Benevolent Fund and appealed for subscribers.

Mr. A. G. Warren then delivered a lecture upon "The X-ray Examination of Materials."

Incorporated Municipal Electrical Association.—The Association has issued a preliminary programme of the 28th annual convention, which is to be held at Scarborough from June 18th to 23rd. The proceedings will include the reading of the following papers: "Showrooms and Sales for Small Undertakings," by Mr. T. Hall, A.M.I.E.E. (Burton-on-Trent); "Overhead Transmission and Distribution," by Mr. J. E. Storr, A.M.I.E.E. (Yorkshire E. P. Co.); and "Modern Generation Applied to Existing Distribution," by Mr. F. W. Purse, M.I.E.E. (West Ham). There will be an informal discussion upon "The Development of Cooking Apparatus."

The annual dinner is to take place on June 21st, and the annual general meeting on June 22nd. The social side has not been neglected; several evening functions and excursions have been arranged.

Iron and Steel Institute.—The annual meeting of the Institute will be held at the Institution of Civil Engineers, London, on May 10th and 11th. The annual dinner will be held on May 10th, and the programme of proceedings includes the presentation of the Bessemer Medal to Dr. W. H. Maw; the award of the Andrew Carnegie Research Scholarship for 1923 will be announced; and amongst the papers that are to be read and discussed is one by Mr. C. A. Ablett on "Economic Principles Governing the Use of Electric Power in Iron and Steel Works." The autumn meeting of the Institute will be held in Milan by invitation of the Italian Metallurgical Association, and will be followed by visits to the chief industrial centres in Italy.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Mr. Harry S. Ellis, M.I.E.E., has been appointed chief engineer and general manager to the West Gloucestershire Power Co., Ltd. For the past three years Mr. Ellis has been in partnership with his brother, Mr. Arthur Ellis, as consulting engineers in Cardiff. The West Gloucestershire Co. expects to be able to supply electrical energy in the Forest of Dean by the middle of June.

To commemorate his 21 years' service as electrical engineer and tramways manager of Blackpool, Mr. Charles Furness received presents from the staff and employés on April 9th. The first gift took the form of a mahogany wardrobe, and the second a set of vases, all presented by the Mayor, who spoke of Mr. Furness's commercial capacity as shown by the progress of the two departments. Mr. R. P. Baxter, chief clerk in the electricity department, spoke of his association with Mr. Furness for 21 years. Mr. H. H. Lancaster, the traffic manager, said the departments were always breaking records. Mr. Furness, in responding, said that many officials in the electricity department had made Blackpool a stepping stone to higher positions, but he felt that if he succeeded it would be a greater honour to remain than to go elsewhere.

In a leaderette last week, referring to the speech delivered at the meeting of British Insulated & Helsby Cables, Ltd., we inadvertently gave the name of the chairman as Mr. George instead of Mr. James Taylor. The name appeared correctly in our "City Notes." It was our sad duty to record the death of Mr. George Crosland Taylor a few months ago.

Manchester Electricity Committee has appointed Mr. W. E. Plowman, shift engineer, Stuart Street, to be turbine superintendent, Stuart Street, in succession to Mr. J. A. Vice, at a salary of £522 per annum. Mr. S. A. Russell, shift engineer, Stuart Street, to the position (*pro tem.*) of assistant resident engineer, Barton Station, at £526 per annum, on the understanding that at a later date Mr. J. A. Vice (assistant resident engineer at Stuart Street) and Mr. Russell exchange positions. Messrs. F. P. Seager and D. Barry have been transferred from the City Station to Barton Station as shift engineers, at £393 per annum (all the above salaries subject to cost-of-living adjustment). Messrs. C. D. Milsom, J. T. Sarvent, A. Willcock, and C. E. Warner have been appointed shift engineers at the Stuart Street, Barton and City power stations respectively.

Manchester Corporation Rivers Committee has passed a resolution thanking Mr. S. L. Pearce, chief engineer and manager of the Corporation Electricity Department, and his assistants for their valued advice and help given in the preparation of the scheme of electrification of the Davyhulme Sewage Works.

Mr. J. H. Storrie, district manager of telephones at Aberdeen, who has just been transferred to the Gloucester area, was presented with a gold wristlet watch by his colleagues in the district office.

The Urban Council of Holywood (County Down), which is to all intents and purposes a suburb of Belfast, has appointed Mr. J. Green, Belfast, engineer of its electric lighting, &c., scheme.

The Wallasey Council has decided that the salary of Mr. B. T. Hawkins, the electrical engineer, be in accordance with the agreed scale of the A.M.E.E.

The Bootle Town Council has presented an illuminated testimonial, passed under the borough seal, to Mr. T. D. Clothier, the borough electrical engineer, on his retirement prior to his departure for South Africa.

At a meeting of the Board of Directors of the American Institute of Electrical Engineers, in New York, on March 16th, Mr. Harris J. Ryan, of Stanford University, California, was adopted as candidate for the presidency of the Institute for the ensuing session.

The daily Press states that Sir David Bruce is being nominated as president of the British Association at its meeting in Toronto in 1924.

Mr. F. C. Raphael, M.I.E.E., who severed his connection with the Edison Swan Company last September, is carrying on his consulting practice at 19, Ludgate Hill, E.C.4. (telephone: Central 3387), where he desires to receive catalogues from manufacturers of lighting fittings, domestic appliances, cables, testing and wireless instruments, &c.

A *Reuter* dispatch, dated Wednesday, Philadelphia, says that the American Philosophical Society has awarded to Sir J. J. Thomson the John Scott Medal and an accompanying purse of one thousand dollars.

Mr. George W. Holford has resigned his position as general manager of the Salford tramways, and his resignation has been accepted by the Committee. He has been in the service of the Salford Corporation for forty years, for many years as tramway manager, he having succeeded Mr. Ernest Hatton, when the latter went to take up the tramway managership at Newcastle-on-Tyne.

Obituary.—Mr. Sydney Gedge.—The electrical industry has lost a very interesting personality by the death of Mr. Sydney Gedge. For many years he was chairman of W. T. Henley's Telegraph Works Co., Ltd., and the back volumes of the Electrical Review contain reports of the speeches delivered by him at the annual meetings of that company. He was prominently and sincerely interested in church affairs, and in educational and other movements which have so much to do with the public well-being and its advance in the things that really matter most. A trade and technical journal may express its admiration for such men and such movements at any time, and especially so when it is of the utmost importance that the right spirit should permeate industrial affairs. The British people need to be reminded that the world is closely watching to see what Britain does by way of giving a lead. But apart from our interest in Mr. Gedge as a typical English gentleman who has spent a lengthy life—he had reached the ripe age of 93 years when he passed away at Mitcham Hall, Surrey, on Friday last—in the furtherance of good causes, he will always be remembered by Henley's directors, shareholders and staff, and by ourselves as Press listeners, as a gentleman of courteous and parliamentary manner, fluent in speech respecting Henley affairs whether he was covering these fully as in the earlier days, or merely generally as in later days when he made a "few remarks" as a sort of preface to the practical and business speeches of Sir George Sutton, Bart., the present chairman and managing director. His parliamentary manner invariably showed itself when the report was submitted for adoption: "Those who agree say 'Aye!' Those who do not say 'No!' (No response from the meeting.) The ayes have it! The ayes have it!" Though Mr. Gedge relinquished the chairmanship in 1917, he remained to the end a director of the company, for the formation of which, it is stated, he was largely responsible in 1880.

Mr. W. H. Willcox, whose death was announced in our issue of March 30th, was governing director of Messrs. W. H. Willcox & Co., Ltd., which business was built up by him from its inception in 1876. Apart from his business activities, he devoted a great deal of time to local public and other affairs in Southwark, where he was personally well known. He was a member of the Worshipful Company of Leathersellers.

Mr. D. Grinsted.—The death occurred on March 29th, at his residence at Bromley, of Mr. Daniel Grinsted, a director of the Bromley Electric Light Co., Ltd.

NEW COMPANIES REGISTERED.

Lead Hydrate Battery Co., Ltd (188,828).—Private company. Registered March 27th. Capital, £500 in £1 shares. To acquire the business of battery and accumulator manufacturers carried on by F. J. Sykes, J. C. Sykes, W. H. Smith and T. J. Bulley at 26, Voltaire Road, Clapham, as the "Lead Hydrate Battery Co." The permanent directors are:—F. J. Sykes, 52, Deauville Road, Clapham, S.W.; J. C. Sykes, 25, Malmains Way, Park Langley, Beckenham; W. H. Smith, 4, Holmesdale Avenue, East Sheen, S.W.14; T. J. Bulley, 26, Voltaire Road, Clapham, S.W. Registered office: 26, Voltaire Road, Clapham, S.W.4.

G. S. Mortley, Sprague & Co., Ltd. (188,775).—Private company. Registered March 20th. Capital, £7,000 in £1 shares (6,250 ordinary and 750 non-cumulative participating 7 per cent. preference). To adopt an agreement with G. E. Mortley and W. Sprague, and to carry on the business of manufacturers of, agents for or dealers in supplies of electrical, mechanical, hydraulic, radio-telephone, wireless telegraph and motor engineers, &c. The first directors are:—G. E. Mortley, 23, Forest Road, Tunbridge Wells (managing director); W. Sprague, Napier House, 25, Nelson Road, Tunbridge Wells. Qualification: 250 shares. Remuneration as fixed by the company. Secretary: W. Sprague. Registered office: 46, Nelson Road, Tunbridge Wells.

Wireless Development Syndicate, Ltd. (188,857).—Registered March 28th. Capital, £1,000 in 5s. shares (2,000 preference and 2,000 ordinary). To carry on the business of manufacturers of and dealers in drawn wire electric cabling and electric lamps and all articles made from tungsten, molybdenum and other metal, manufacturers of electrical instruments and appliances, and metal products, &c. The subscribers (each with one share) are:—H. Atkinson, 54, Hillcrest Road, Acton Hill, W.3, machinery agent; H. M. Taylor, 17, College Hill, E.C.4, secretary; E. Holwill, Temple Chambers, E.C.4, merchant; B. Quin, 21, Longbeach Road, Clapham Common, S.W.11, secretary; W. H. E. Stone, 32, Balcombe Street, Dorset Square, N.W.1, clerk; J. C. Scrivener, "Mistleigh," Caterham Valley, surveyor; M. N. Buttershaw, "Fairlawn," Woodside Road, Sutton, Surrey, retired solicitor. The first directors are: H. Atkinson and E. Holwill. Minimum cash subscription, £1 15s. Remuneration: £50 each per annum (chairman, £75). Secretary (*pro tem.*): H. Hawkins. Solicitor: W. H. Lane, 17, College Hill, E.C.

Thames Electric Wireless Co., Ltd. (188,924).—Private company. Registered March 29th. Capital, £100 in £1 shares. To carry on the business of electrical, mechanical, and general engineers and contractors, manufacturers of, and dealers in wireless, radio, electrical, and scientific instruments and machines, &c. The first directors are:—R. C. Watkins, 64, Forthbridge Road, Clapham Common, S.W.11 (chairman); W. F. Watkins, 28, Church Lane, East Finchley, N.2; H. W. Woods, "Offley," Kingsdown Road, Surbiton, Surrey; F. P. Sexton, 2, Bolton Gardens, Teddington, Middlesex. The first two are permanent. Qualification, 5 shares. Registered office: 40, Old Town, Clapham, S.W.4.

Fallon Condenser Manufacturing Co., Ltd. (188,907).—Private company. Registered March 29th. Capital, £1,000 in £1 shares. To carry on the business of manufacturers, importers and exporters of and wholesale and retail dealers in radio-telephonic and telegraphic appliances, accessories, supplies and devices, &c. The permanent directors are:—M. J. Fallon (managing director), 230a, Hermitage Road, N.4, radio engineer; E. J. Fallon, 230a, Hermitage Road, N.4. Qualification, 1 share. Secretary: M. J. Fallon. Registered office: 230a, Hermitage Road, N.4.

A. W. Knight, Ltd. (188,970).—Private company. Registered April 4th. Capital, £2,000 in £1 shares. To take over the business of radio and electrical engineers and mineralogists carried on by A. W. Knight and H. J. Bywaters as "Knight & Bywaters." The permanent directors are:—A. W. Knight, 26, Stanbury Road, S.E.15, radio engineer; H. J. Bywaters, 10, Barforth Road, S.E.15, mineralogist. Qualification, £200. Remuneration as fixed by the company. Solicitor: J. W. Nutt, 200, Tower Bridge Road, S.E.1.

Radio Products, Ltd. (188,862).—Private company. Registered March 28th. Capital, £250 in 244 "A" shares of £1 each and 120 "B" shares of 1s. each. To carry on the business of electrical engineers, including radio, X-ray, and allied sciences and arts, &c. The first directors are:—A. R. Kearney, 6, Templers Avenue, N.W.11 (permanent managing director); C. G. Barkshire, 27, St. Alban's Road, Harlesden, N.W.10. Qualification, 1 "A" or "B" share. Registered office: 55, Broad Street Avenue, E.C.2.

Venner Grills, Ltd. (188,836).—Private company. Registered March 27th. Capital, £8,000 in £1 shares. To adopt an agreement with B. G. Battson, J. F. Woosnam and H. G. White for the purchase of a licence to manufacture, make, use, exercise and vend electrical heating and cooking apparatus under letters patent granted to R. F. Venner. The permanent directors are:—A. Armitage, The Court, Worcester Park, Surrey (chairman, British Motor Spirit Co., Ltd.); B. G. Battson, The Friary, Holmesdale Road, Hampton Wick, Middlesex; Major A. W. Pegrum, Teddington Hall, Teddington, Middlesex; T. Whiteley, Guest House, Chalfont St. Peter, Bucks. Qualification: £25. Remuneration (except managing director) £50 each per annum and a percentage of the profits. Registered office: 215, Piccadilly, W.1.

Beaver Electrical Supply Co., Ltd. (188,900).—Private company. Registered March 29th. Capital, £1,000 in £1 shares. To carry on the business of mechanical and electrical engineers, machinists, electroplaters, manufacturers of, and dealers in apparatus used in connection with wireless telegraphy and telephony, hardware, &c. The first directors are:—R. E. Beevor, 3, Addington Mansions, Highbury, N.5; Dorothy A. Beevor, 3, Addington Mansions, Highbury, N.5. Qualification, 10 shares. Registered office: 109, Regent Street, W.1.

Stevenston and District Electrical Supplies Co., Ltd. (12,631).—Private company. Registered in Edinburgh, April 4th. Capital, £500 in £1 shares. To carry on the business of electrical and electric lighting engineers, plumbers, gasfitters, contractors, &c. The first directors are:—J. C. Weir, 2, Moorpark Road East, Stevenston, electrical engineer; W. J. Thomson, 8, Holmhead, Kilbernie, wine and spirit merchant. Qualification, 100 shares. Registered office: 83, New Street, Stevenston, Ayrshire.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Pirelli-General Cable Works, Ltd.—Particulars filed of £300,000 first mortgage debenture stock authorised January 31st, and covered by trust deed dated March 19th, 1923, constituting a specific charge on leaseholds at Southampton and a floating security on the company's undertaking and other property, present and future, including uncalled capital, the whole amount being now issued. Trustees: British Trusts Association, Ltd.

Teignmouth Electric Lighting Co., Ltd.—Issue on March 13th, 1923, of £800 debentures, part of a series already registered.

Moodys, Ltd.—W. A. J. Osborne, of Balfour House, 119, Finsbury Pavement, E.C., was appointed receiver on March 21st, 1923, under powers contained in mortgage or charge dated October 2nd, 1922.

Turner, Atherton & Co., Ltd. (66,901).—Return dated August 14th, 1922 (filed March 3rd, 1923). Capital, £140,116 in 62,861 preference and 77,255 ordinary shares of £1 each. 49,172 preference and 51,597 ordinary shares taken up. £26,487 paid on 7,250 ordinary and 19,228 preference shares. £74,282 considered as paid on the remainder. Mortgages and charges, nil.

Northampton Electric Light & Power Co., Ltd. (28,640).—Return dated March 2nd, 1923. Capital, £350,000 in 10 "A" and 349,990 "B" shares of £1 each. 10 "A" and 289,990 "B" shares taken up. £290,000 paid. Mortgages and charges, £150,000.

Burgess Hill and District Electric Supply Co., Ltd. (85,698).—Return dated March 9th, 1923. Capital, £6,000 in 3,000 ordinary and 3,000 preference shares of £1 each. All shares taken up. £5,900 paid. £100 considered as paid. Mortgages and charges, £1,200.

Wireless Equipment, Ltd. (138,072).—Return dated December 31st, 1922. Capital, £2,500 in £1 shares. 1,300 shares taken up. £700 paid. £600 considered as paid. Mortgages and charges, nil.

Quain Electric Co., Ltd.—C. W. Rooke, of 2, Norfolk Street, Strand, W.C., ceased to act as receiver and manager on January 26th, 1923 (notice filed March 28th.).

Simoon Engineering Co., Ltd.—H. C. Chambers, of 5, Chancery Lane, W.C.2, ceased to act as receiver or manager on March 28th, 1923.

Stanley Gayner & Co., Ltd.—Particulars filed of £750 debentures authorised March 20th, 1923, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

"B. N. B." Wireless, Ltd.—Debenture dated March 26th, 1923, to secure £300, charged on the company's undertaking and property, present and future, including unpaid capital. Holder: J. McCurdy, 19, Cressingham Road, New Brighton, Wallasey.

Kent House Engineering Co., Ltd.—Mortgage dated March 15th, 1923, to secure £470, charged on lands and premises in Beckenham, and ranking in priority over certain debentures. Holder: S. W. Pearson, "Vista," Wykeham Avenue, Hornchurch, Essex.

City of Buenos Ayres Tramways Co. (1904), Ltd. (82,214).—Return dated March 1st, 1923. Capital, £1,240,000 in £5 shares. All shares taken up. £1,240,000 considered as paid. Mortgages and charges, £174,000.

Clarke, Chapman & Co., Ltd. (39,045c).—Return dated March 23rd, 1923. Capital, £550,000 in 7,000 preference shares of £10 each and 480,000 ordinary shares of £1 each. 6,985 preference and 444,000 ordinary shares taken up. £10 per share called up on 4,435 preference, £1 per share on 55,360 ordinary, and 5s. per share on 2,000 ordinary shares. £100,210 paid; £413,700 considered as paid, being £10 per share on 2,550 preference, £1 per share on 386,700 ordinary, and 15s. per share on 2,000 ordinary shares. Mortgages and charges nil.

CITY NOTES.

London Electric Wire Co. and Smiths, Ltd.

Presiding at the annual meeting held at River Plate House, E.C., on April 6th, Sir G. H. Fisher-Smith, in reviewing the accounts and the course of business, said that the profit and loss account showed a reduction for the year of £19,493. Although 1922 was the most difficult year he remembered, the result shown on the balance-sheet was most reassuring. The second half of 1922 showed signs of gradual improvement throughout the engineering trade, which were still evident, customers' orders considerably exceeding those of a year ago. The directors therefore had no hesitation in recommending the same final dividend on the ordinary shares as was paid for the previous year, making 7½ per cent., less tax, for the year, leaving £30,671 to be carried forward into 1923. While it was impossible to forecast the future, he felt sure that 1922 was the bottom of the depression, and if industrial unrest were avoided by both sides considering what was best in the interests of industry, trade would continue to improve. The speaker referred to the enormous burden of taxation on industry, which left no margin for business development, and was strangling the commerce of the country. He also called attention to the Rating of Machinery Bill, which had been before Parliament for four years. He asked shareholders to urge their Parliamentary representatives to vote for this Bill to introduce a uniform system of assessing buildings, and buildings only, for local rating purposes. The company's plant and workpeople were most efficient, and fully prepared for the trade revival which he hoped would materialise.

German Companies.

The *Star Works Co.*, makers of electrical apparatus, of Frankfort-on-Main, reports net profits of 423,000 marks for the first year's activity, and a dividend at the rate of 8 per cent.

The *German Telephone Works and Cable Industry Co.*, of Berlin, reports net profits of 35.3 millions of marks for 1921-22, and a dividend at the rate of 50 per cent.

The directors of *Siemens Electrical Works Co.*, which owns supply stations and is also interested in others, report that the works yielded a gross surplus of 157.1 millions of marks in 1921-22, as against 28.6 millions in the previous year. But owing to the further depreciation of the mark, particularly in relation to the company's Swiss loan, the loss of 162.6 millions in 1920-21 is stated to have now risen to 2,726 millions of marks. It is proposed to prepare a scheme of reconstruction.

Scarborough Electric Supply Co., Ltd.

The total profit for 1922 was £15,108; this with £7,613 brought forward makes a total of £22,721. The depreciation fund receives £10,000, and bank interest requires £1,405. From the balance of £11,316, the directors recommend the payment of a dividend of 5 per cent., less tax, absorbing £5,000, and the balance is to be carried forward. The new connections made during the year were equivalent to 7,293 30-W lamps, making a total of 183,929. The energy sold increased by 262,215 kWh to 1,989,341 kWh. A new 1,000-kW turbo-alternator and a boiler have been put into working, and a second similar set is on order. In order to provide for the new plant and to pay off the bank loan, an issue is being made of £60,000 (part of £80,000) first mortgage debenture stock. Meeting: April 14th.

Pinchin, Johnson and Co., Ltd.

At the annual general meeting, on April 3rd, the chairman (Mr. Edward Robson) said that the results had fully justified their previous optimism and their business had shown expansion in every market, particularly those oversea. The subsidiary companies were also obtaining satisfactory trading results and would contribute a steadily-increased revenue to the profits of the parent company. Since the clearing-off of a small mortgage of £6,000, the company was free from all debt, and cash balances and investments in trustee securities amounted to no less than £178,000.

With regard to future prospects, he had no hesitation in saying that the ability of the company to deal with an ever-widening volume of trade would ensure prosperity. He looked forward to a very satisfactory year if matters at home and abroad were cleared up and the burden of taxation ameliorated.

Brush Electrical Engineering Co., Ltd.

The profit and loss account for 1922 shows that, after providing for general charges, maintenance of plant and buildings, and interest on the company's debenture stocks, &c.; there remains £247,837, making, with £120,368 brought forward, a total balance of £368,205, subject to part excess profits duty for 1920 and previous years, income and corporation profits taxes. There is being put to depreciation of buildings and plant, £15,000; a further 4 per cent. interest on the prior lien participating second debenture stock requires £2,044; patents and goodwill are written down to a nominal amount of £1, absorbing £19,599, and there is put to general reserve £34,405. A dividend at the rate of 10 per cent. per annum on the ordinary shares for the year requires £45,856 and £251,301 is to be carried forward. The general reserve account has been increased during the year by £15,595, profit on purchase of the company's debenture stocks for sinking fund purposes and profit on sales of shares in other companies. The further £34,405 now appropriated to this account raises the general reserve fund to £200,000. £70,081 was expended on capital account during the year. The new turbine shop and other extensions of the works have been completed and the advantages of greater capacity and improved economy in the manufacture of Brush turbo-generator sets have been secured. In common with the whole of the engineering industry the company was affected by the national wages dispute with the men's unions, which involved the practical closing of the works for a period of three months. The general trade depression which prevailed during the past year has been felt in the decreased number of contracts obtained in both the engineering and rolling stock departments, and will have the effect of reducing the prices for the current year, although the directors hope that the recent improvement in trade may be maintained. The directors refer with deep regret to the death of Mr. B. S. Broadhurst. Mr. William Henry Massey, M.V.O., has been elected a director of the company.

Stock Exchange Notices.—The undermentioned have been ordered to be officially quoted:—

Yorkshire Electric Power Co.—830,000 6 per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 830,000; and £190,000 5½ per cent. redeemable debenture stock.

Metropolitan Electric Supply Co.—1,000,000 ordinary shares of £1 each, fully paid (Nos. 1 to 1,000,000), and 380,605 4½ per cent. cumulative preference shares of £1 each, fully paid (Nos. 1 to 380,605).

Application has been made to the Committee to allow the following to be officially quoted:—

Melbourne Electric Supply Co.—£300,000 six per cent. redeemable general mortgage debenture stock.

Dealings in the following have been specially allowed by the Committee under Rule 159:—

Central Electric Supply Co.—£337,700 five and a-half per cent. secured and guaranteed notes (registered), within Nos. 1 to 1,272 (£50), 1 to 2,344 (£100), 1 to 184 (£500), and 1 to 110 (£1,000).

Bath Electric Tramways, Ltd.—According to the *Financial Times*, the profit for 1922, after deducting £20,480 for repairs and renewals and £2,416 for income tax, and including £2,234 brought forward, was £17,253. After providing £5,396 interest on debenture stock, £1,000 for instalment of sinking fund and dividend on preference shares, and £5,000 transferred to contingencies and renewals account, there remains £2,107 to be carried forward to provide for contingencies and replacements.

Chiswick Electricity Supply Corporation, Ltd.—The directors report that for 1922 the total revenue was £49,827, against £43,722 in 1921. After paying sinking fund premium and trustees' fees, the profit was £23,789, less interest on debenture stock, £3,287. The directors recommend a dividend of 10 per cent., closing the suspense account by writing off £6,639, placing £8,000 to depreciation reserve and carrying forward £2,621.

Pritchett & Gold & E.P.S. Co., Ltd.—According to the *Financial News*, the directors recommend a dividend of 10 per cent., free of tax, on the ordinary shares for the year. £15,493 to general reserve (making £55,150); £3,332 to special depreciation of plant; £30,438 carried forward, subject to income tax and corporation tax. Last year the dividend was at the same rate, less tax.

Winnipeg Electric Railway Co.—Gross earnings for 1922, $5,395,223; net operating revenue, $1,868,508. After meeting debenture and other charges, the net income was $935,374. Dividends on preference stock amount to $210,000, and additional allowance for depreciation amounting to $138,459 has been provided, leaving $385,865 to be transferred to surplus.

Tynemouth and District Electric Traction Co., Ltd.—Dividend on the ordinary shares at the rate of 10 per cent. for 1922. £4,454 carried forward.

Electrical Utilities, Ltd.—A dividend of 1¼ per cent. on the preferred stock for the quarter is announced.

Hadfields, Ltd.—Final dividend of 6d. per share, making 5 per cent. for the year, tax free.

English Electric Co., Ltd.—Dividend of 5 per cent., less tax, on the ordinary shares for 1922.

Indo-European Telegraph Co., Ltd.—Final dividend of 22s. 6d. per share, free of tax, making 7 per cent. for the year.

Cuba Submarine Telegraph Co., Ltd.—Final dividend of 5s. plus a bonus of 4s. per share, free of tax, on the ordinary shares, making 5 per cent. plus a bonus of 2 per cent., free of tax, for the year.

STOCKS AND SHARES.

Tuesday Evening.

Labour has shouldered its way into Stock Exchange markets in its usual unceremonious fashion, bringing about a general jostling of prices in Home Railway stocks, and causing a little disturbance amongst a few industrials. Apart from this, however, the investment parts of the Stock Exchange are decidedly good. The War Loan has risen to the best price it has attained since it was issued. Most of the other British Government stocks stand at substantial premiums above the prices at which they were offered. In the market for prior-charge Home Railway stocks, the debentures have risen to rather under a 5 per cent. basis.

In a list before us giving the amount of stock actually on offer, there is no supply of City & South London, London Electric or Central London debentures. London Electric 4 per cent. preference is equally lacking in supply. The same state of affairs prevails in other investment parts of the Stock Exchange. People are looking forward to the Budget being "broken" on Monday night, an event which, in previous years, has usually been awaited with mistrust and apprehension, but which, this time, is anticipated with something akin to pleasure.

The Home Railway market gave way sharply, in consequence of the slight alarm produced by fears of a strike being called on the railways. Metropolitans have dropped abruptly. The steam stocks gave way all round. This applies to the ordinary stocks only. The prior-charges are, as already stated, almost, if not altogether, unobtainable. Underground Electrics gave way with the others. Nothing official has transpired to account for the recent remarkable jump in Metropolitans; rumour still busies itself with the possibility of reorganisation of capital in the case of the Underground Electric Railways.

Metropolitan Electric Supply shares now figure as £1 shares in the Stock Exchange Official List. The ordinary £1 shares are quoted at 28s., equivalent to 7 for the old £5 shares, which is 7s. 6d. higher than last week's quotation. The 4½ per cent. preference stand at 17s. London Electrics moved up to 4½, and there are small improvements in Charing Cross ordinary and preference, City of London, County of London and Westminsters. South Londons at 6¼ are ex the dividend. Newcastle-on-Tyne shares recovered the deductions made last week; the ordinary at 17s. 6d. are rather better. Whitehall Electric preference have risen to 19s. 6d., and the debentures to 93¾. County of London new ordinary shares are strong at 13s. 9d. premium, and the new preference keep firm at 2s. 3d. premium.

The Stock Exchange annual report shows that the managers of the House have decided to "scrap" their own electric lighting plant, which has been in operation for a good many years. Instead, they are now taking current for lighting and power from the City of London Company and the Charing Cross, West End and City Electricity Supply Company. It will be interesting to see how the expense under the new arrangement compares with that under the old *régime*. In the year just ended, the Stock Exchange spent £8,425 for electric power, working and maintenance, an increase of £2,020 over the expenditure in 1921-22.

Globe Telegraph and Trust ordinary strengthened to 18¾. Eastern Extension and Eastern Telegraph ordinary stocks are both ex dividend. Great Northerns rose to 28½, and Indo-Europeans at 37½ show a gain of 2. Oriental Telephones advanced to 2 13/16. Marconis continue to be a quiet market at 2 9/16. There is nothing much doing in the shares, speculation having died away for the time being, while the uncertainty respecting the broadcasting monopoly induces a certain amount of caution in the minds of those who might otherwise be tempted by Marconi shares, on the strength of the company's profitable connection with the latest craze. Radio Corporations have been in demand from New York, the common at 18s. and the preference at 16s. 3d. There is, however, no fresh activity in Canadian Marconi. Curiosity is agog in regard to the manner in which capital is likely to be supplied for the erection of the Marconi Company's new stations. One suggestion is that there may be a flotation of one, or more, subsidiary concerns in South Africa, India or elsewhere, that shall be responsible for raising the necessary capital. It may be remembered that the Marconi company still have a substantial claim against the Government, a claim which has not yet been satisfied, in connection with work done during the war.

Anglo-Argentine Tramways shares are weak, in consequence of the statement that fares on the system are to be lowered. This has given rise to a little uneasiness in regard to the maintenance of the dividend on the second preference, the price of which fell 3/16, while the first preference are ¼ down. British Columbia Electric preference strengthened to 83¼, and Brazilian Tractions to 53. The Mexican group is quiet. London United Tramways debenture stiffened to 65. British Electric Tractions show no alteration.

General Electrics are 1s. up at 21s. 9d., and the "A" preference at 22s. 6d. gained 6d. Henley's preference at 4½ are ½ better, but Callender's preference at 1⅛ show 1/16 fall, and so present an excellent opportunity for investors to acquire cheap shares. The 6½ per cents. can be bought at 23s., giving 5¾ per cent. yield on the money, with dividends due in January and July. There are also a thousand or so of the company's 7½ per cent. preference available at 26s., affording about the same return, and with dividends payable at the same time.

Babcock & Wilcox have again advanced on vague amalgamation rumours. India-rubber shares rose to 15s. Metropolitan-Vickers preference at 2½ are ex dividend. Siemens are a better market at 21s. 3d. British Insulated ordinary gave way to 47s., and it is thought that some people may be changing from these into Callender's, as both shares receive the same rate of dividend, 15 per cent., and Callender's stand at 45s.

In the rubber market there is little going on, though a fair amount of strength remains in the prices. Iron, coal and steel shares are better on the whole, the continued chaos in the Ruhr district being regarded as favourable to British industry in the trades mentioned.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Nom.	Dividend. 1921.	Dividend. 1922.	Price April 10. 1923.	Rise or fall.	Yield p.c.
	£					
Brompton Ordinary	1	12	12	36/6	—	£6 11 4
Charing Cross Ordinary ...	5	9	14	10½	+⅛	6 16 7
do. do. do. 4½ Pref.	5	4½	4½	4¼	+ 1/16	5 6 0
Chelsea	5	6	10	8	—	6 5 0
City of London	1	14	15	46/3	+9d.	6 9 0
do. do. 6 % Pref. ...	1	6	6	23/-	—	5 4 4
County of London	1	8	10	37/6	+6d.	5 6 8
do. do. 6 % Pref. ...	1	6	6	1⅛	—	5 4 4
Edmundson's Ordinary	3	Nil	—	2½	—	Nil
do. 6 % Pref. ...	5	12/-	—	4⅜	—	6 13 4
Kensington Ordinary	5	10	12	8½	—	6 13 4
London Electric	3	4	10	4⅜	+ 1/16	6 11 7
do. do. 6 % Pref. ...	5	6	6	5⅛	—	5 17 1
Metropolitan	1	7	8½	28/-	+ ⅜	6 1 5
do. 4½ % Pref.	1	4½	4½	17/-	+ ⅛	5 6 0
Newcastle-on-Tyne Ordinary ...	1	Nil	2½	7/8xd.	—	2 17 2
do. 5 % Pref. ...	1	5	5	15/-xd.	—	6 13 4
do. 7 % Pref. ...	1	7	7	23/6xd.	—	5 19 2
Notting Hill, 6 per cent. Pref....	10	6	6	9½	—	6 9 9
North Met. Elec., 6 % Pref. ...	1	6	6	1⅛	—	5 13 0
Urban Ordinary	3	Nil	—	1½	—	Nil
do. 5 % Pref. ...	5	2½	—	4¼	—	5 17 8
St. James' and Pall Mall ...	5	12	14½	10½	—	6 18 0
South London	4	7	10	6¼xd.	—	5 16 3
South Metropolitan Pref. ...	1	7	7	1⅜	—	5 14 10
Westminster Ordinary	5	10	12	8¾	+ ⅛	6 17 3
Whitehall Elec. Invst., 7½ % Pf.	1	7½	7½	19/6	+9d.	7 13 10

Home Rails.

Central London Ord. Assented	Stock	4	4	71	+1	5 12 8
Metropolitan	,,	2½	3½	68½	—1½	5 2 2
do. District	,,	1	3	56	—	5 7 2
Underground Electric Ordinary	10	Nil	Nil	3¼	— ⅛	Nil
do. do. "A" ...	1	Nil	Nil	9/6	—	Nil
do. do. Income	Stock	4	5	95½	—1½	*5 4 9

Telegraphs and Telephones.

		Dividend. 1920.	Dividend. 1921.			
Anglo-Am. Tel. Pref.	Stock	6	6	104	—	5 15 5
do. Def.	,,	1½	34/6	22⅜	— ¼	6 13 4
Chile Telephone	5	6	6	6¼	—	4 16 0
Cuba Sub. Ord.	10	7	7	7½	—	9 6 8
Eastern Extension	10	10	10	18¼	—	5 9 7
Eastern Tel. Ord....	Stock	10	10	183½xd.	—	5 9 0
Globe Tel. and T. Ord.	10	10	10	18⅜	+ ⅛	5 8 10
do. do. Pref.... ...	10	6	6	11¼	—	5 6 8
Great Northern Tel.	10	24	22	28½	+ ½	7 14 4
Indo-European	25	10	10	37½	+2	6 13 4
Marconi	1	25	15	2⅜	—	5 17 0
Oriental Telephone Ord. ...	1	12	12	2⅞	+ 1/16	*4 5 5
United R. Plate Tel.	5	8	8	7⅛	—	*5 6 8
West India and Panama ...	10	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	10	18⅜	—	*5 9 7

Home and Foreign Trams, &c.

Anglo-Arg. Trams. First Pref.	5	5½	12½	3⅜	— ⅛	7 11 8
do. do. 2nd Pref.	5	Nil	5½	3⅜	— 1/16	8 3 0
do. do. 5 % Deb.	Stock	5	5	84½	—	5 18 3
British Electric Traction Ord.	,,	4½	—	74½	—	6 0 10
do. do. 6 % Pref.	,,	6	6	99	—	6 1 3
Brazil Tractions...	100	Nil	Nil	53	+1	7 11 0
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	83½	+1	5 19 9
do. do. Preferred	,,	5	93/-	77½	—	*6 1 3
do. do. Deferred	,,	3	124/-	89½	—	*6 18 6
do. do. Deb. ...	,,	4½	4½	78	—	5 8 3
Lond. & Sub. Trac. 5 % Pref.	1	2½	3½	11/-	—	9 2 0
London United Tram. Deb. ...	Stock	4	4	65	+ ½	6 3 0
Mexico Tram. 5 % Bonds ...	—	Nil	Nil	31½	—	6 2 8
do. 6 % Bonds ...	—	Nil	Nil	61½	—	Nil
Mexican Light Common ...	100	Nil	Nil	22½	—	Nil
do. Pref.	100	Nil	Nil	52½	—	Nil
do. 1st Bonds ...	—	Nil	5	66½	—	7 11 3

Manufacturing Companies.

Babcock & Wilcox	1	15	16	8⅞	+ 1/16	4 4 0
British Aluminium Ord. ...	1	10	5	18/9	—	5 1 6
British Insulated Ord.	1	15	15	2½	—3/-	6 8 0
Callenders...	1	15	15	2¼	—	6 13 4
do. 6½ Pref.	1	6½	6½	1⅛	— 1/16	5 15 7
Crompton Ord.	1	10	5	⅞	— 1/16	6 13 4
Edison-Swan	1	10	Nil	4/8	—	Nil
do. do. 5 % Deb.	Stock	5	5	61	—	8 1 4
Electric Construction	1	10	10	28/-	—	7 2 10
English Electric	1	8	5	17/9	—	5 12 8
do. do. Pref.	1	6	6	18/6	—	6 9 9
Gen. Elec. Pref.	1	6½	6½	22/9	+6d.	5 14 3
do. Ord.	1	10	5	21/9	+1/-	4 12 0
Henley	1	15	15	47/6	—	6 6 4
do. 4½ Pref.	5	4½	4½	4⅜	+ ⅛	5 2 10
India-Rubber	1	10	—	⅝	+ 1/16	—
Met.-Vickers Pref.	2	8	8	2½xd.	—	6 8 0
Siemens Ord.	1	10	10	21/3	+6d.	Nil
Telegraph Con.	12	20	20	25½xd.	—	*4 16 0

* Dividends paid free of Income Tax.

ONE REASON FOR FAULTS IN WIRING WORK.

By K. F. BISHOP.

This article applies to wiring in places where damp air has access to the ends of rubber-insulated wires, such as in bathrooms, wash-houses, lavatories, garages, and similar situations in buildings which are never heated, or are unduly heated at intervals, thus giving rise to condensation.

It also applies to outside lighting where the wires are drawn into pillars and pipes, and where the ends may or may not be effectively taped over at the terminals.

In all these situations troubles occur much more frequently than is necessary, the effect being usually an open circuit on single cables, which may arc through the covering to earth, and an open circuit or short on twin cables.

The blame is usually cast on the cable, but it is quite likely that the following has happened:—

The ends of the wires have not been treated in any way or have merely been taped over, leaving some of the wires uncovered, so that damp air or even actual moisture has been sucked up by the strands hygroscopically, this being accelerated by condensation due to the cable being alternately heated and cooled.

The moisture in the strand, aided by the free sulphur in the rubber, attacks the copper, or rubber, or both together. Before long the weakest part of the tinning is eaten away, and the action between the moisture, copper, rubber, and sulphur is in full blast. This, aided by the electric current passing, results first in arcing between the corroded strands, then charring of the rubber, and finally a gradual perishing of everything concerned.

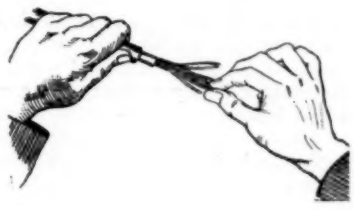
Eventually the affected piece of cable is cut out and styled a fault, the unfortunate maker being asked to explain matters.

To be comparatively free from such troubles does not need more than a very few minutes' work on each cable end, as follows:—

Bare the conductor for about 2 in.

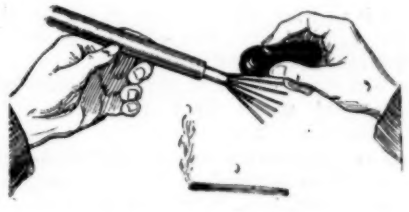
Strip the tape and braid, or lead, or cab-tire sheathing from the insulation for another ½ in.

Unstrand the conductors and spread them out radially.



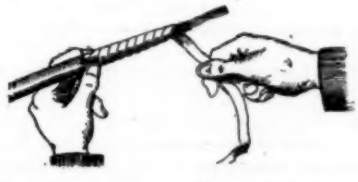
Heat the end of a bar of Chatterton compound—a match will usually do. (Choose a Chatterton compound that is easily plastic).

Rub the sticky end of the bar along each unstranded wire for an inch, leaving the other inch clean for connecting up, also make a blob where the strand enters the rubber so as to effectively seal up that portion also.

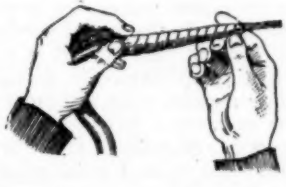


Re-strand these wires by twisting them neatly, finish tightly with pliers, and mould the Chatterton over the end of the rubber sheath. This will now form a solid-filled strand up which moisture cannot creep.

Make this more solid by pressing around the taped end with the fingers.



Tape over this Chattertoned part of the strand, covering also the insulation, and an inch of the sheathing, preferably with "N" tape—two layers should be sufficient. This will allow 200 taped ends per lb. of "N" tape.



This will leave a cable end which may be used in damp air or even immersed in water without any trouble ensuing.

LOOSE CONTACT THERMOPHONES.

By LESLIE MILLER.

This description of a practical type of receiving microphone, operated by heat, is intended to call the attention of the scientific world, and especially of wireless experimenters, to the use of microphones as receivers. It does not seem to be generally known that they can be employed at both ends of the line, or at the receiving end when the transmission is wireless.

In any telephone circuit, consisting of a transmitter, a battery to maintain a steady current, and a receiving microphone of the loose-contact type with the two contacts pressed lightly together, the last-named will retransform into sound waves those impressed on the transmitter, with great naturalness, but only moderate volume.

It remains to find the best materials for the contacts. Theoretically, any solid conductor, even metals, may be employed; but, up to the present, the writer has had the best results with the sulphides of lead (galena), and of iron (marcasite, in the fused form), also with carbon, and especially when one contact is carbon and the other galena. In an earlier paper, read before the Wireless Society of London on November 23rd, 1921, marcasite was said to be best, but further experience showed that it was not always stable in the presence of damp and heat. It is, however, of very low resistance, and the difficulties connected with it may be surmountable. The best forms of galena are the wireless rectifying crystals, sold under the trade names of "Permanite," "Hertzite," &c.

To bring the reproduced sounds conveniently to the ear, an ordinary metal telephone case, as used for head 'phones, may be employed, with one contact fixed in the centre of the diaphragm, and the other at the point of a fine-thread adjusting screw, tapped through the back of the case. For the diaphragm, a mica gramophone disk, one-fifth of a millimetre thick, can be recommended, with a thin piece of galena, backed by metal, or copper plated, fixed at the centre by a small nut and screw. The other contact, which presses slightly against the galena, can be a carbon point, but, in practice, three carbon shot, of about 1.5 millimetres diameter each, lying side by side in a small flat-bottomed cup, of brass or carbon, are more consistently good in action, though not quite so sensitive.

Instead of a mica diaphragm, the usual Stalloy iron one may be employed. In this case the permanent magnets of the ordinary telephone may be left in position, the wire on them being removed. The inward pull of the magnet counteracts the outward push of the screw.

To give the best reproduction, it is not enough that the alternating current caused by sound waves hitting the transmitter should pass through the contacts, as would be the case if the thermophone was in the secondary of a transformer, or if there was a condenser in the circuit. A direct current must also flow through the receiving contacts, of a strength found by experiment to give the loudest result, without burning or harming them. This, of course, depends on their resistance, and the current may be anything between one milliampere and fifty. It is usually different from that needed by the transmitter, and should be obtained from a battery of 2-6 volts. In the case of wireless reception, this may be the filament battery, but it must be borne in mind, when joining up the circuit, that galena-carbon forms a very fair rectifier that will more or less stop the current one way.

The reason sound is reproduced at the broken contact is, doubtless, the same as that which produced motion in the well-known Trevelyan rocker, explained many years ago by Prof. Tyndall. The two conductors cohere, owing to the formation of a minute bump on the surface of one of them, where the heat is localised at the point of contact. This forms a short conducting bridge that expands and contracts with the varying alternating current, and moves the diaphragm with it.

Since a microphone, plus a Bell telephone, reproduces speech more or less satisfactorily, it is safe to say that the microphone alone must do its part remarkably well. This gives good ground for thinking we shall be building on a good foundation when developing a receiver on the same lines.

The resistance of a galena-carbon contact in actual use for reproduction may be 150-1,000 ohms, depending on the kind of galena. The resistance of this should suit the circuit in which it is employed. Such a contact does not obey Ohm's law. The current increases much faster than the pressure.

The reproduction of the voice, and music, is excellent as regards quality, but in their present stage of development more energy is required to work thermophones than ordinary telephones. As these, according to Prof. Fleming, only convert usefully one part in a thousand of the energy they receive into sound waves, there seems plenty of promise for a heat-operated instrument, now in its infancy, but which can already almost always be used in substitution for the other, by the aid of some additional power. For instance, signals from American stations can be received with it quite well, when a good commercial aerial and four or five valves are available. Broadcasting from 2 L O can be heard very pleasantly, with an average amateur aerial, one detector, and two low-frequency valves, 12 miles away, where this was written. There is less distortion than in a good wireless telephone, worked from the same old A Mark IV amplifier, in order to see the difference.

The fact that heat effects are cumulative, and the absence of appreciable self-induction and capacity, or the need, for wireless purposes, to rectify the current, are points that make these thermophones form a very promising field for research.

THE RELATION OF LAY-OUT TO COSTING.

By FREDERICK W. POPE.

The relation of lay-out to costing seems, at first sight, very remote. In practice it is not so.

Lay-out is chiefly considered in its bearing upon production. No less, therefore, is its bearing upon the costing of production. Anyone who undertakes the interesting task of organising a costing system discovers this in his preliminary investigations.

The ideal generally accepted in engineering works design is that departments should be arranged in order of processes, and that the ground plan should take the form of a horseshoe, with the stores in the centre. Thus the receiving and dispatch departments are brought together in the ordinary course of routine, and the stores are easy of access from any part of the works. Whether or not this well-known "horseshoe" design is better than any other is outside the present question. The essentials are: (1) that all work should move forward, in certain planned order, towards the fitting shops, and (2) that "overhead" departments (such as tool room and stores) should be self-contained—quite separate from the producing departments.

Such arrangements are necessary for the correct recording of all expenditure, direct and indirect.

Direct expenditure covers all labour and material which can be charged direct to the job. In a properly laid-out factory it can easily be arranged that operations shall follow a sequence, and here it is that the influence

on costing can be seen. A system of planning enables the cost office to check whether all operations have been allocated to the correct order number. The cost clerk would know, for example, that a stator case is turned and bored, drilled and tapped, and that the feet are machined; he would know, also, the order of these operations. If, when a time card has been issued for the second operation, he finds that no time has been recorded for the first, he knows at once that someone has forgotten to "clock on." (There are safeguards against this possibility, but a check is never superfluous.)

It is, however, in matters of indirect, or "overhead," expense that lay-out helps or obstructs the costing system. Two examples may be given: the first of expense departments, the second of machine-hour-rates.

The expense departments are a charge upon the product, and this charge has to be assessed as accurately as possible. It scarcely needs to be pointed out that where such departments are separate and distinct, the calculations are simpler than they would otherwise be, and a finer degree of accuracy is ensured. The stores department is a notorious offender against these elementary principles, and consequently needs special attention.

The system of allocating overhead charges by machine-hour-rates calls up the whole question as to how the various machines should be arranged. For the sake, not only of the costing system, but of the efficiency of the factory generally, machines must be grouped in their various classes. This facilitates the fixing of rates, not for single machines merely, but for groups of similar machines.

No costing system can be brought to a state of efficiency in an out-of-date factory, but in finding costs most firms find also the weak places in the factory, and a gradual reconstruction is, or should be, the next step.

ELECTRICITY IN THE HOME.

Mr. J. W. Beauchamp, director and secretary of the B.E.D.A., read a paper, illustrated by lantern slides, on January 9th at the North-Western Centre of the Institution of Electrical Engineers, in which he generally reviewed the position reached in the electrification of the home to-day. A great many ladies attended the meeting.

The author suggested that co-operation between the architect and the electrical engineer should be much closer, and asked for more foresight in the design of buildings and for more provision to be made for electrical equipment from the start. To cater for lighting alone, particularly in isolated situations, was often difficult on account of the small revenue obtainable and large expenditure incurred. A good case could be made for the use of small devices, but it was necessary that a reasonable number of "outlets" should be included in the wiring installations, and if the electrical appliances were not to be obtained on hire, their advantages must be made known by adequate demonstration, temporary loan, or other means. The cost of wiring had fallen considerably in the past year, but there was great need for systems of wiring on hire-purchase terms—by easy, but terminable payments. When the original installation had been altered out of recognition, or the people suggested that they had paid for it a dozen times over, it would probably be expedient to let the payment lapse, the system having done its work of securing the wiring of houses which would not have been possible otherwise.

The wisdom of making ample provision for mains capacity was shown by the following rough figures relating to the capacity of cable with the total cost as laid (lead-covered of armoured cable with board cover, jointing, excavation, and permanent reinstatement of flag pathway):

Table I.

	Copper Area. Sq. in.	Ratio of Area. Per Cent.	Cost Laid. Per Cent.
Twin Cable ...	0.0145	100	100
	0.0225	155	101.2
	0.06	413	125.2
	0.1	690	145.8

Table II.

Three-core Cable	Cost Laid Per Cent.	Cost of 3-core cable laid as percentage of twin ditto.
.0145 × .0145 × .007 sq. in. ...	100	... 105.4
.0225 × .0225 × .0145 sq. in ...	101.9	... 106.2
.06 × .06 × .04 sq. in. ...	137.4	... 115.6
.1 × .1 × .06 sq. in.	163.2	... 118.0

One of the most active districts in London (and one of the oldest) which enjoyed a single-phase a.c. system was rapidly coming to the conclusion that in certain districts a return would be made to the old house-to-house method of distribution, running 2,000-volt distributors along streets into transformers in the basements of blocks of flats or groups of three or four large houses. Estimating for the domestic load hinged upon diversity and its value; every month brought fresh evidence that the diversity of this load was much higher than was anticipated. Figures had been quoted of from 6 to 10 for a bulk of cookers, occasional fires, lighting, irons, &c., and they were certainly not too high. The realisation of this made an immense difference to anyone laying out cable systems and machinery to meet a domestic demand. If one divided the price of the therm of gas by 8, one got a figure which was very reasonable for electric cookery and occasional heating; moreover, a figure which had proved to be correct in recent practice. 1 or 1½ kWh per head per day for cookery amounted (at 1d. per kWh) to about 3s. 9d. per week for a small family, which was less than people paid for gas cookery when the rate was 5s. a 1,000 cu. ft., or from 11d. to 1s. a therm.

It had been necessary to study the value of service to the user rather than the scientific basis of cost. When one was out for cookery business in an ordinary English city, one was not so much concerned with the exact figure at which one ought to hire out the cooker as with the figure which would persuade people to use an electric in place of a gas cooker. But when hiring vacuum cleaners and washing machines they might have to be sure that the terms were on a strictly commercial basis, because the amount of energy used in the year by those appliances was so small that one could not hope to recoup oneself for errors in that direction. A generous policy with regard to hiring and efficient "service" organisation was essential to any extensive use of the electric range; it would also increase the use of fires and motor-driven appliances, and hiring should, if at all possible, be applied to any considerable expenditure which might be incurred for additional wiring; the latter item, if a large percentage of the price of the fires or cooker, was a serious factor in checking development.

The consumption in a small house where electricity was used for lighting, flat irons, kettles, and similar small appliances could easily be from 50 to 100 per cent. above that derived from lighting only, and where "occasional" fires and regular electric cooking was employed from 6 to 10 times the lighting consumption; this extended use might be provided for by a 30 per cent. or 40 per cent. increase in the *expenditure* on mains and services which would be required for lighting alone.

In an area having 150,000 inhabitants (say, 25,000 houses) and selling 20 million kWh per annum for light, power, &c., it would be possible by the introduction of electric cookery and partial heating in one-fifth of the houses to increase the output by 50 per cent.; or again, in an industrial centre of half a million inhabitants, now using 150 million kWh per annum, mostly in industry, it would be only necessary to supply 2,000 kWh per annum each to 75 per cent. of the houses in that area in order to double the output of the station.

Everyone desired electric light and would get it sooner or later; that was to say, the "small consumer" might increase in number and constitute a serious problem unless steps were taken to make him a relatively large consumer, when he might be the mainstay of many a power station, using energy to his own benefit and that of the whole community and providing a load but little affected by trade conditions.

Electricity supply, if supported by adequate "service work," could obtain a varying, but often substantial, increment in price over comparative values as between electricity, gas, and coal, and the ultimate solution of the "small consumer" difficulty must lie in converting him into a larger consumer, *satisfying him that some of his expenditure on fuel* might be diverted to the supplier of electricity, and that to use the public supply for lighting alone was to miss some of its greatest advantages.

A characteristic of the City of Manchester noticeable to the stranger was the many thousands of small and narrow-fronted working-class houses built together in blocks and occupying short spur roads to the right and left of the principal thoroughfares, even quite near to the centre of the city. Mr. Beauchamp suggested that a serious effort should be made to provide these people with the advantages of electricity for lighting if nothing else. The difficulties need not be so great as those presenting themselves in connection with new and more widely scattered colonies of modern working-class

houses. These small and inconvenient houses would be even more benefited by the use of electric lighting than the better ones, and cable could be run along the front of the houses over the level of the front door. He strongly recommended his hearers to consider the large business to be done amongst these small dwellings. Under normal conditions of trade, the occupants were not exactly poor—they would use, say, from 90 to 120 kWh a year, say, £2 12s. a year, or 1s. a week average. They would certainly not get adequate gas lighting for less than 9d. a week average across the year (assuming for lighting 80 watts for 1,500 hours, or 5 ft. of gas for 1,500 hours). If possible the tariff should take the form of a small fixed charge, something like 6d. a week, the kWh used (for any purpose) being metered and charged for in addition, a flexible method that would make it possible gradually to provide these people with some other small conveniences, such as kettles, irons, &c.

In their efforts to get rid of the "idle chimneys," they had met with some opposition from architects and building authorities. They appeared to regard as risky any radical change in design, and feared they might tie their tenants to a particular form of heating or cookery, and that in the future the price of electricity might be increased and householders be left rather at the mercy of the supplier of that commodity—a probability which no electrical engineer of experience found it possible to contemplate; quite the contrary was likely to happen.

The author asked the architect to consider with a more open mind the use of overhead wires and of surface wiring inside buildings, provided that the work was carried out soundly and with proper regard to appearance. If in every house built at least one duct were left through the wall of each room into the hall, staircase, or passages, that would be an immense convenience, often save much expense and mess at a later date, and the principal check to the fuller use of electrical accessories would be removed. He knew of certain blocks of flats wherein the provision for electric heating and cooking in addition to lighting was so considerable that cables had been abandoned, covered ducts constructed in the walls, and copper busbar on insulators being employed in their place.

The domestic load could not be secured by price cutting alone; if the price of apparatus were suddenly halved and the ½d. unit available again, they would not get an immense rush for the electrification of homes. The whole thing was bound up with a consistent and efficient advertising, personal propaganda, hire or hire-purchase, demonstrations, and service work; given those facilities they could as easily obtain a fairly competitive price as a cut one.

No one need fear that propaganda work was in any way undignified; it was more in the nature of public education than of advertisement.

Discussion.

In opening the discussion, Mr. J. Frith upheld the author's remark about the absolute necessity for a cheaper and simpler system of wiring. At Grange-over-Sands they had an overhead system carried on the trees and chimney pots and by various backways, which entered the houses in a most unobtrusive manner. They were far too fussy about the wiring of houses, and if they continued as they were doing now they would make the wiring of houses such a stupendously good job that nobody but the multi-profiteer would be able to afford it. He did most of his wiring at home over the picture moulding. He was quite sure that a great deal of the unpopularity of electricity in the home was due to faulty flexible conductors.

Mr. A. B. Mallinson complained of the price of electricity, of the frequent changing of the rate of charging, and of the pressure of the supply. "We hesitate very much to switch on anything extra, because we know the light will go down." Getting the wires to the house was too elaborate to-day. In Canada they shut their eyes to what were here called obvious defects of overhead wires. They did the job cheaply and quickly. It was all right to talk about the new houses, but it was even more important to speak about the houses that already existed. They offered a possible load far bigger than was obtainable from the new houses. Regarding flexibles, for once Mr. Frith and he were entirely in agreement.

Mr. H. C. Lamb said that the number of additions in the Manchester area averaged over 150 domestic consumers per week, and the increased consumption per week by new consumers for heating was something over 100 kW.

Mr. Valentine said that for seven years his wife had used electric irons, and electric heaters had been in use, but no flexible or iron had ever been out of order.

Alderman Walker pointed out that the sooner they adopted a system that had an all-in rate for every household use the sooner would they appeal to the ordinary consumer. He was convinced that they had been putting too much wiring out of sight in tubes that did not run all the way. There was a great deal to be said for having it where it could be seen. The moment overhead wiring was mentioned, pressure was brought to bear upon the members of the City Council not to use any more. It was pure prejudice and grossly unfair. In nine cases out of ten the unnecessary expense which was condemned was due to ratepayers taking the prejudiced views of some person who knew less about it than they did, and who warped their judgment. He had no doubt himself that if an estate were laid out with a neat overhead system the objection would disappear. More damage was done to the development of the use of electricity by making exaggerated claims than in any other way. Claims were still being made that could not be substantiated. Electricity could not compete with the coal fire in many respects, and he was glad Mr. Beauchamp suggested that there should be at least one or two coal fires in the house in order to get central heating and a hot-water system for general use, with electric fires for intermittent use.

Mr. A. Shelton emphasised the remarks made by Alderman Walker with regard to exaggerated claims. The prospective consumer went away disappointed because of what he or she had read in advertisements. Combining central with electrical heating had not been driven home sufficiently. He would go so far as to bunch houses together in order to reduce the cost of the central-heating installation.

Mr. J. W. Beauchamp said that the point he wanted to make was: "Don't say electricity is expensive or that it is cheap without knowledge of the prices of electricity." He did advocate surface wiring, or one system against another, but he rather liked the wiring where he could see it. The rateable value system had many defects, but it was the best multipart tariff in use in this country, and the defects did not show themselves in places where there were houses of the villa type. However, they would see a revival of interest in the floor-space system. It would be much better policy to say: "The rate is 1½d.—or something reasonable—but we are not in a position to give the required power for heating or cooking" than to keep off consumers by fixing an exorbitant rate.

RUSSIAN ELECTRICAL TRUSTS.

An Electro-Technical Trust.

The most important Russian electrical trust is the Electrotechnical Trust for the Central Region, which was first formed in February of last year, and has now disclosed the extent of its activity down to the end of December. The trust is divided into four groups. The first comprises the dynamo works in Moscow, and the former A.E.G. branch works, which was removed from Riga to Kharkoff. In the second group are embodied the Russian Cable Works and the former Alexevsky Cable Works, which are both situated in Moscow. The third group, also in Moscow, consists of the lamp factories of Pokrovska, Koodrinska, and the Meshanska. The fourth group is composed of the Insulator Works and Electric Carbons, which are situated in Moscow and Koodinove respectively, and the Electrical Apparatus Works in Gjheli, and the Essen Works in Slavanske.

According to a tabular statement contained in the official records, and dealing with the value of the output month by month, the production of the works forming the trust in the opening month of February amounted to 936,000 gold roubles on the basis of the 1914 price lists, or 46.2 per cent. of the production in the same month in 1914. After various fluctuations in the following months, the value of the output reached 1,035,000 gold roubles in November, and further increased to 1,197,000 roubles in December, or 51 per cent. of that in the same period in 1914. The total turnover for the eleven months is returned at 9,660,000 gold roubles, or slightly over 44 per cent. of the value of the total production in 1914.

Great variations took place in the degree of activity of the different groups of works. In those producing machines the value of the production in the ten months ended with November represented only 19.3 per cent. of the value of the output in the corresponding period of 1914. The percentage held by the cable works in the same period was 60.9 of the equivalent ten months in 1914, that of the lamp factories was 84.3 per cent., and that of the group of auxiliary branches was 22 per cent. The variations are explained by the situation of the inland market, there having been a much larger demand for cables and insulated conductors and lamps than for machines and general electrical accessories.

The works comprised in the trust employed 7,110 persons in 1914, of whom 5,946 were workmen and the remainder were officials. Last year the total number of both classes ranged from 5,360 in February to 5,565 at the close of November, or 75.2 per cent. and 78.3 per cent. respectively of the numbers in 1914. As to the efficiency of the workmen, it is stated that by the end of last year the productivity of the men on the average had already reached 63 per cent. of that in 1914, and that taking into consideration the fact that the length

of the shift in the meantime had been reduced from ten to eight hours, the present average efficiency amounts almost to 80 per cent. of that which prevailed in 1914.

In conclusion, it may be mentioned that the programme fixed for this particular trust in the present year provides for the employment of 6,459 workmen out of a total of 12,500 workmen for the four trusts combined, that is, including the Electro Machine Trust, the Accumulator Trust, the Light Electrical Engineering (Weak Current) Trust, and the Volta and Karbolit works. As these trusts are expected to be operated this year at a loss of 3,000,000 gold roubles, it is intended to grant them a subsidy of this amount.

The "Weak-Current" Trust.

The works producing telephone and telegraph apparatus, including radio apparatus, and railway signalling appliances in Russia have been nationalised and placed in the hands of a single concern known as the "Weak-Current" Trust. The trust comprises five undertakings in Petrograd, three in Moscow, and one in Nizhni Novgorod.

According to Russian official information, the largest and best-equipped works embodied in the trust are to be found in Petrograd, which may be considered as the centre of the industry, as they produce about 80 per cent. of the total output. Moscow occupies the second position, while the third is taken by Nizhni Novgorod, where is situated the former works of Siemens and Halske, which were begun in 1916 and brought into operation in 1919.

The former works of the Ericsson company, now known as the "Red Dawn," produce telephone apparatus, &c., and in the near future the works will be engaged on the manufacture of the equipment for the Kharkoff telephone exchange, which will comprise from 40,000 to 60,000 subscribers. At the former Siemens works in Petrograd is concentrated the production of radio apparatus, together with the output of ordinary telephone apparatus of various systems and of measuring apparatus. Telephone and telegraph apparatus is also turned out at the former Geissler works, while the Robtit works have been adapted to the manufacture of electro-technical appliances, Röntgen tubes, generators, and thermionic valves.

In general, the Moscow works of the former Morse undertaking are occupied with the production of Morse apparatus, as well as telephone appliances. Accessory appliances are also turned out at these works along with materials which are furnished to the other works in the trust. The production of radio apparatus is concentrated in Moscow. These works recently turned out two transmitting generators on the Poulsen system for the Detskoski radio station. It is claimed that the trust has at its disposal large and well-equipped works.

The number of workmen employed by the trust on January 1st, 1923, was 2,135. The turnover of the trust in the first quarter of the new financial year—October-December, 1922—is estimated at 534,000 gold roubles, or about 30 per cent. of the pre-war production. Most of the output devolves upon the former Geissler and Ericsson works, which more than the others are approaching the volume of the former peace-time production. About 90 per cent. of the output of the works is for State departments, the balance being for some of the hundreds of trusts in the country and for State institutions. The postal authorities are blamed for not placing orders with the trust, but their policy is said to be changing, and the trust expects large orders from this department. It is proposed to endeavour to develop business with Siberia, the South, and the South-East, and for this purpose the establishment of branches and representatives in the localities concerned is held in prospect.

The value of the production of the trust in January is returned at 165,000 gold roubles, or slightly less than in December. Since then the situation of business has improved, and the total orders on hand at the end of February are valued at 2,974,000 gold roubles, while further orders are in prospect for 1,635,000 gold roubles. The financial position of the trust is reported to have greatly improved in recent times, inasmuch as the former State aid of about 66 per cent. of the working funds had been reduced to 4.6 per cent. by the end of 1922, the proceeds from the sale of manufactures having considerably grown in the meantime.

MAGNETIC DRUM RECORDERS AND TRANSMITTING KEYS.

The application of a revolving magnetic drum to electric relays, siphon recorders, and radio transmitting keys was described by Mr. N. W. McLachlan, D.Sc. (Eng.), M.I.E.E., on Wednesday last before the Wireless Section of the Institution of Electrical Engineers. The instrument consists essentially of an iron drum with an annular recess in which is situated one or more coils of wire, the ends being connected to slip-rings, fig. 1. The drum is mounted on ball bearings and its periphery, which is shod with cast-iron rings, is machined to run true to 0.0001 in. A small iron or steel shoe fits accurately the curvature of the rings. When a current passes through the coil, the drum is magnetised, and this causes the shoe to be pressed on the rings with considerable force. Thus, if the drum is revolved, a force is required to cause the shoe to slide relatively to the rings. The magnitude of the tangential pull thus obtained is many times greater than that calculated from the product of pressure due to magnetic attraction. The ratio of experimental pull to calculated pull (taking μ as 0.6) depends on the flux density at the shoe contact, and may exceed 50, fig. 2. Thus the action of the device appears to depend on some form of cohesive action incited by magnetism. The paper deals with this phenomenon, but more particularly with its application to electric relays, siphon recorders for line and radio-telegraphy, and transmitting keys for radio-telegraphy, the electric circuits for single-current, double-current and valve-circuit working being described in detail.

The highest speed yet attained with a working voltage of 100 is 280 w.p.m., but this is not the limit. It has been increased to 320 w.p.m. by augmenting the battery voltage and decreasing the inductance of the drum by reducing the number of turns (4,000 in this test). However, these figures are probably adequate for all practical purposes in radio-telegraphy for some time hence. The present design has been altered from the original, inasmuch as the shoe has been made thicker, and therefore heavier, and the siphon longer. A speed of 200 w.p.m. can be obtained readily with 100 volts, but higher speeds necessitate higher voltages to ensure a sufficiently rapid rise and fall of current.

If an alternating current is supplied to the recorder, it will function in such a way that all the alternations appear above the datum line, due to the fact that the magnetic pull is independent of the direction of the current. Such an effect may be designated as a form of electro-mechanical rectification. The action is enhanced by using a small polarising current in one of the coils. It is possible to obtain a reaction effect. The moving system is set into rapid vibration and emits a note, the pitch of which can be varied, and the frequency varies between about 200 and 500 periods per sec. By a suitable arrangement the same effect can be obtained in double-current working. The recorder is electrically irreversible, the only back e.m.f. being that due to inductance.

In an instrument of this class, what is required particularly is a large force resulting from a small energy input, and this can be fulfilled most easily by working at low speeds and using a coil of many turns. For any given speed of working there is a practical limit to the force obtainable from a given

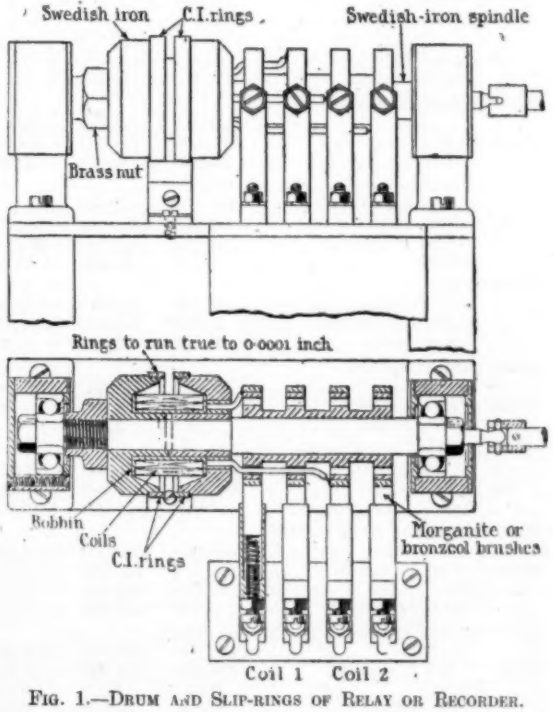


Fig. 1.—Drum and Slip-rings of Relay or Recorder.

input. The various phenomena may be summed up by stating that the instrument oscillates, rectifies, and amplifies. It does electro-mechanically, therefore, what a triode does electrically.

The apparatus is robust and compact. The ratio (working torque/moment of inertia) for a given signal current is com-

paratively large for an electromagnetic recorder. The transit time for an amplitude of 0.05 in. is approximately 1/700 sec. It is insensitive to change of speed, *i.e.*, no adjustment is required if the speed is varied from 20 to 200 w.p.m. The initial adjustment is far from being critical. The lengths of marking and spacing can be varied over a wide range when the instrument is functioning. This is a great advantage if

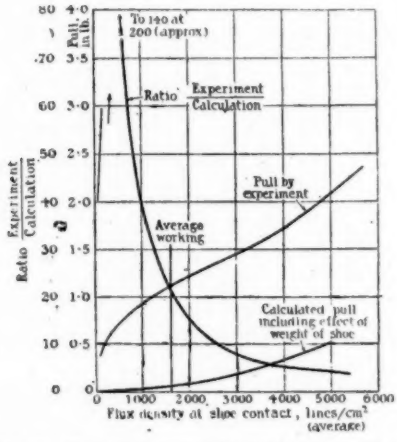

To 140 at 200 (approx)
Pull in lb.
Ratio Experiment / Calculation
Pull by experiment
Average working
Calculated pull including effect of weight of shoe
Ratio Experiment / Calculation
Flux density at slot contact, lines/cm² (average)

Fig. 2.—Recorder with Lowmoor Iron Shoe.

the transmitter is sending light or heavy characters. The marking on the tape is of rectangular formation, and is remarkably legible at all speeds. The working current is very small and the instrument will function in a valve circuit without the use of an intermediate relay. Being fitted with relay contacts, the incoming wireless signals can be recorded and relayed to a land line simultaneously. The marking end of the siphon is rigid and cannot overshoot.

ELECTRICAL IMPORTS OF INDIA.

The following statistics of the imports of electrical and similar goods into British India in the year ended March 31st, 1922, are taken from the recently-issued official trade returns, details for the year ended March 31st, 1921, being added for purposes of comparison, and notes of any increases and decreases given.

	1920-21 £	1921-22 £	Inc. or dec. £
Control and switchgear—			
Total	64,000	153,000	+ 89,000
From United Kingdom	63,000	132,000	+ 69,000
,, United States	1,000	21,000	+ 20,000
Electrical generators—			
Total	451,000	798,000	+347,000
From United Kingdom	220,000	687,000	+467,000
,, United States	229,000	89,000	−140,000
Electric motors—			
Total	614,000	1,497,000	+883,000
From United Kingdom	501,000	1,055,000	+554,000
,, United States	96,000	405,000	+309,000
,, Sweden	8,000	24,000	+ 16,000
Transformers—			
Total	43,000	160,000	+117,000
From United Kingdom	13,000	130,000	+117,000
,, United States	30,000	29,000	− 1,000
Turbo-generating sets—			
Total	89,000	124,000	+ 35,000
From United Kingdom	87,000	121,000	+ 34,000
,, United States	2,000	2,000	—
Other electrical machinery—			
Total	927,000	1,166,000	+239,000
From United Kingdom	608,000	831,000	+223,000
,, Italy	6,000	31,000	+ 25,000
Electric fans and parts thereof—			
Total	399,000	550,000	+151,000
From United Kingdom	148,000	183,000	+ 35,000
,, Italy	61,000	146,000	+ 85,000
,, United States	183,000	206,000	+ 23,000
Electric wires and cables (rubber insulated)—			
Total	549,000	348,000	−201,000
From United Kingdom	498,000	291,000	−207,000
,, Japan	11,000	2,000	− 9,000
,, United States	39,000	48,000	+ 9,000
,, Germany	—	3,000	+ 3,000
Ditto, insulations other than rubber—			
Total	417,000	601,000	+184,000
From United Kingdom	402,000	554,000	+152,000
,, United States	2,000	34,000	+ 32,000
,, Germany	—	10,000	+ 10,000
Telegraph and telephone wires and cable—			
Total	31,000	13,000	− 18,000
From United Kingdom	28,000	13,000	− 15,000
,, United States	1,500	—	− 1,500
,, Japan	1,500	—	− 1,500
Bare copper wire (electrolytic)—			
Total	218,000	124,000	− 94,000
From United Kingdom	64,000	76,000	+ 12,000
,, United States	106,000	41,000	− 65,000
,, Japan	41,000	3,000	− 38,000
Telegraph and telephone apparatus—			
Total	50,000	50,000	—
From United Kingdom	32,000	40,000	+ 8,000
,, Sweden	9,000	8,000	− 1,000
,, Japan	1,000	1,000	—
,, United States	8,000	1,000	− 7,000
Electric glow lamps—			
Total	169,000	243,000	+ 74,000
From United Kingdom	104,000	123,000	+ 19,000
,, Holland	47,000	60,000	+ 13,000
,, Japan	3,000	2,000	− 1,000
,, United States	8,000	10,000	+ 2,000
,, Germany	2,000	19,000	+ 17,000
Electric lamps, other sorts—			
Total	73,000	36,000	− 37,000
From United Kingdom	35,000	20,000	− 15,000
,, Holland	23,000	3,000	− 20,000
,, Japan	9,000	3,000	− 6,000
,, United States	5,000	2,000	− 3,000
,, Germany	1,000	5,000	+ 4,000
Batteries—			
Total	28,000	21,000	− 7,000
From United Kingdom	11,000	12,000	+ 1,000
,, United States	17,000	9,000	− 8,000
Carbons, electric—			
Total	8,000	5,000	− 3,000
From United Kingdom	7,000	4,000	− 3,000
,, United States	1,000	1,000	—
Accumulators—			
Total	153,000	84,000	− 69,000
From United Kingdom	142,000	78,000	− 64,000
,, United States	11,000	5,000	− 6,000
Condensers, electric—			
Total	5,000	500	− 4,500
Electric lighting accessories and fittings—			
Total	314,000	302,000	− 12,000
From United Kingdom	277,000	255,000	− 22,000
,, United States	23,000	26,000	+ 3,000
,, Germany	3,000	9,000	+ 6,000
Electricity meters—			
Total	84,000	76,000	− 8,000
From United Kingdom	71,000	60,000	− 11,000
,, Switzerland	8,000	6,000	− 2,000
,, Germany	—	4,000	+ 4,000
Electro-medical apparatus—			
Total	7,000	7,000	—
Switchboards other than telegraph and telephone—			
Total	55,000	135,000	+ 80,000
From United Kingdom	36,000	110,000	+ 74,000
,, United States	19,000	22,000	+ 3,000
Other electrical goods and apparatus—			
Total	1,618,000	1,457,000	−161,000
From United Kingdom	1,026,000	1,006,000	− 20,000
,, Germany	12,000	19,000	+ 7,000
,, Italy	13,000	15,000	+ 2,000
,, Japan	45,000	23,000	− 22,000
,, United States	513,000	376,000	−137,000
Telegraphs, materials for construction and accessories other than electrical—			
Total	9,000	42,000	+ 33,000
From United Kingdom	7,000	8,000	+ 1,000
,, United States	2,000	32,000	+ 30,000
Telephones, materials for construction and accessories other than electrical—			
Total	65,000	271,000	+206,000
From United Kingdom	42,000	242,000	+200,000
,, Sweden	12,000	10,000	− 2,000
,, United States	19,000	15,000	− 4,000

In addition to the foregoing, the following were imported as Government stores:—

Machinery and millwork—			
Total	856,000	1,061,000	+205,000
From United Kingdom	849,000	982,000	+133,000
Telegraph material—			
Total	419,000	465,000	+ 46,000
From United Kingdom	417,000	444,000	+ 27,000
Instruments and apparatus—			
Total	664,000	951,000	+287,000
From United Kingdom	655,000	887,000	+232,000

HIGH-SPEED ALTERNATORS.

Discussion at Manchester.

Mr. J. Rosen's paper on the above subject (which was abstracted in our issue of February 23rd) was read at the North-Western Centre of the Institution of Electrical Engineers on March 6th, Mr. A. S. Barnard presiding.

Prof. Stoney said that of all abominable things, d.c. high-speed dynamos were about the worst.

Mr. G. A. Juhlin said that while the author had shown a solution of the difficulties experienced in rotor retaining rings, he was not clear whether the definite cause of that trouble was known. The firm with which he was associated, after investigation, came to the conclusion that the trouble was due to eddy currents burning the steel and causing fine air-cracks, which finally developed so that pieces came out of the end rings. Experience caused them to modify that judgment, and they believed that, while the trouble was probably accentuated by the burning which took place when short circuits occurred in machines, that was not altogether the cause of the failure. They found that without any appreciable evidence of burning on the tips of the rings there were signs of cracks in the steel, and they came to the conclusion that the trouble was very largely a mechanical one. The ring was supported on a spigot and the end ring had a press fit on to the shaft; when a rotor was in its bearings there was deflection of the shaft, so that the ring actually took up a position at an angle to the rotor; and at every revolution of the rotor the ring changed its position, so that there would be a series of hammer blows given to the ring at the point where it fitted on to the rotor. To get over that difficulty they had adopted another construction. In order to support the ring independently of the shaft, the rotor chamber was made larger and it was trepanned close up to the body. The ring was seated on an annular ring fixed to the body. The ventilation of a machine built in 1911 and still running at Huddersfield was practically the same as that mentioned by Mr. Rosen. They were still using a modified scheme of that type. Credit for the introduction of the air cooler was due to the French Westinghouse Co., which in 1917 already had a 5,000-kW turbo-alternator operating with a closed air-circuit system.

Mr. H. C. Lamb thought that the chart showing the breakdowns was remarkable, and ought to be brought home to the insurance companies. The rates of insurance to-day varied from 3 to 6 per cent. per annum of the total value of the alternator. With a record of failures of only 1 per cent. per annum, it appeared that one should be able to effect insurance at a very low rate indeed. He did not agree that rotor failures were few and easily remedied—at any rate, his rotor failures were just double the stator failures, or 10 per cent. per annum. It appeared that because a rotor was run at low voltage insufficient care was taken to put in really sound insulation. A series regulator was not really used for the purpose of regulating, but as a stand-by to the exciter.

Mr. G. F. Sills, with reference to the author's remarks on the question of the stranded cable, said that certain British cable-makers were making sector-shaped cables on those lines, except that they had not got insulation between turns. Apparently they did it in rather a different way from the author's, but they were not crushed in any way. With regard to ventilation, he was at a loss to see where the patent came in. A somewhat similar arrangement was used as long ago as 1917. There was no reason why they should not go in for the external fan arrangement. Wet filters had a bad name, but it was because of the way they had been used. He had recently seen similar oscillograph records made by another manufacturer which confirmed the author's conclusions.

Dr. S. F. Barclay said, with regard to breakdowns, that it was misleading in the first instance to select only stators, because the rotor gave far more trouble in general than the stator. Low-voltage machines really ought not to fail. With reference to the insulation tubes on the stator conductor being eroded by grit, that was not a thing that could not be corrected; the air ought to be filtered or a closed system should be used. "The very safe and conservative figure of 300 ft. per second" as the peripheral speed was coupled with a running speed of from 1,000 to 3,000 r.p.m., which was quite unfair. They ought not to speak of constant peripheral speeds without reference to the diameter. The remarkable statement, "Moreover, it is possible to deform a cap 25 in. diameter, 1 in. thick, by as much as ¼ in. on the diameter during its assembly over the windings," indicated very brutal treatment. If a wet air-filter was in proper adjustment and properly run, no free moisture could get over. The trouble with these filters, of course, was that the water circulated over and over again. In Sheffield, beginning on Monday morning when the water was fresh, they analysed the water every 24 hours, which showed that the acid content went up quite steadily during the week until at the end of the week the water was quite acid. The closed system of ventilation was much more satisfactory. To-day there was no excuse for manufacturers building exciters which were not stable.

Mr. J. A. Kuyser thought that the most interesting part of the paper was the description of the design of the 18,000-kVA alternator. The mechanical difficulties must have been very great, and they had been solved in a very excellent manner. The author found in America that the difficulty in designing higher-speed machines lay in the alternator and not in the turbine, and that ventilation appeared to be a limiting factor, but in this country they had overcome the difficulty, and it was possible to build a machine of any length without regard to ventilation. They had a system similar to that of the author. In connection with the field switch, he and the author had come to the same conclusion, but the author seemed to be rather doubtful about eddy currents. In connection with the stranded conductor, some of the statements in the paper appeared to be conflicting. It was possible to prevent all movement of the stator conductors themselves; there might be some small movement of the stator, but the end connections were made of flexible material, and no harm was done. The main thing to guard against was deformation of the stator bars themselves, and that could be done.

Mr. D. S. Paxton thought that the sand-blast action of the grit was eloquent testimony to the necessity of installing some sort of a filter. Everybody agreed that the closed-air system was a good thing, but it could not be applied in every case. The difficulty of the wet-air filter could be removed by the utilisation of the viscous oil-film type of filter. On the Continent during the last five years over three million kW of plant had been equipped with this type of filter. During the past year 50 or 60 machines had been equipped in this country, and everybody who had used it had found it very satisfactory in operation.

Mr. L. W. Schuster said that the presence of residual oils was advocated in order to obtain flexibility of stator insulating tubes. His firm had had adverse experiences of the splitting of insulating tubes in the manner described, and it did not seem that the remedy given was the final solution of the difficulty. One of the first ideals to be aimed at was a fireproof machine. A similar remark applied to the use of a bituminous compound between the tubes and the slots. Designers were compelled at present to use materials that were not pre-eminently suitable, but with the evolution of large turbo-alternators they would be forced to develop some form of fireproof construction.

Mr. A. B. Mallinson said that surely it was not possible for a fire to take place in a closed-air circuit. Perhaps the insurance companies would give an abatement for closed-air circuits.

Mr. J. Rosen, in reply, explained that the 4,000-kW machine at the Carville power station had been subjected to over 400 short circuits, and was still going strong. It was probably built in 1905. Sufficient credit was not given to British engineers. Mr. Bond, of Battersea, and his assistants were experimenting as early as 1913 and 1914, and certainly they had a cooler in commission in 1915. He showed the possibilities of the air cooler, and credit should be given to him. The 20,000-kW machine mentioned was for the new London (Barking) station. Many of their troubles had perhaps been due not so much to design as to external causes in many cases. A series regulator was useful as a stand-by, but in some stations, especially in America, they were very large, and one felt inclined to do without them if one could.

Discussion at Leeds.

The paper was read at the North-Midland Centre of the Institution of Electrical Engineers on February 20th, Mr. W. B. Woodhouse presiding.

In opening the discussion, Mr. Townley (Bradford) asked whether the 47,500-kVA turbine mentioned in Table I was a single machine. He was under the impression that Messrs. Parsons preferred turbines of that size to be compound, and that it was rather a new departure for them to go back to such large machines on a single shaft. It had usually been found advisable to split machines into two parts in order to get a lower speed for the low-pressure end of the turbine, which simplified construction. Recently particulars were published of a 65,000-kVA machine in the United States, and in a recent issue of a German technical journal reference was made to a 60,000-kVA single machine that was built during the war, and some particulars were given of a machine of 160,000 kVA, designed to run at 1,000 revolutions. He was somewhat surprised that the author now told them that water cooling was unnecessary even for large machines running at 3,000 revolutions. Could one feel satisfied that on high-speed machines the stator core construction was perfectly satisfactory for air cooling, without resorting to water? Manufacturers had a great deal of information in their possession with regard to machine temperatures, about which the user knew very little indeed; unfortunately, users did not get the benefit of their researches. With the author's statement that "The improvement is still more striking when it is considered that the conditions of operation in a modern power station have become more severe with the advance of time," he did not agree; they did many things in the old days because they were in total ignorance of what was happening inside the machines. With the necessity of avoiding rigid insulation, he quite agreed, and could vouch for the effectiveness of the Parsons method of obtaining flexible insulation. With the

increasing length of stators and the high temperatures at which they were now running, trouble caused by expansion might become quite marked. He agreed that the closed system was the best method of dealing with the air-filter problem. The use of fireproof insulation for end windings would avoid a great danger. A steel cap, or steel-wire rotor cap, fastened in a proper manner would be more satisfactory than a cylindrical copper cap around which the stresses were very unequal. High voltages induced in the shaft of high-speed machines could be cured by short circuiting the shaft inside the bar pedestals.

Mr. Melton observed that rotor bonding was a good point. The reversal of the exciter under short circuit and other abnormal conditions did occur, but he had never found it do very much harm. The end poles might be constructed as a wire-wound gun would be, with rectangular section wire, if they could secure the ends. He was rather surprised at the low voltage Mr. Rosen found in the rotor body under short circuit, and believed the American practice in many stations, particularly on the Canadian side, was to connect arresters across the exciter bearing pedestal to earth, to protect the insulation.

Mr. Henzell thought that the closed ventilating system was the right thing now. They were very much inclined to err on the safe side rather than let a machine rise to the temperature it might go to. It would seem that the material would stand temperature all right, expansion being the limiting point. He did not like the separate ventilating fan; it was adding another auxiliary. Mr. Rosen was probably correct in saying that they could not design an efficient fan to run at the speed required, but he thought they could design a mechanical fan to do it. Fireproof end windings were most important.

Mr. Mather agreed that the closed system of ventilation would be used for most large machines in the future. The Parsons ventilating system was the most scientific and most efficient in use at the present day, but the external fan constituted the weak link in the chain. A compromise would be to drive the fan by means of the alternator shaft in similar manner to the one in which the governor was driven. Distinctly connected with the ventilation of the machine was the question of reactance. The problem which central station engineers were faced with was very often to fit a comparatively large machine into an engine room that was very much too small for it, and it therefore was not always easy to find a place for reactances and at the same time to make a suitable arrangement of main cables. It would appear to be desirable that the reactance should, if possible, be contained in the machine itself, and, with the tunnel type of slot which the author recommended, that should not be difficult.

Mr. S. D. Jones suggested that it might be possible to make a cooler somewhat in the nature of an evaporating condenser.

In replying to the discussion, Mr. J. Rosen thought that in the German machines they were going a little too far. If they wanted a safe machine they had to run at low peripheral speeds, and that made the machine longer. When considering peripheral speed they had only to remember the number of breakdowns they had heard of lately; it was a question of "safety first." Actually water cooling gave them an increased output of 17 per cent., but that did not warrant the additional cost. They used fireproof insulation on the rotors, but at present did not consider it advisable for the stators. Fireproof insulation was all right at low temperature, but as soon as the temperature increased there was the possibility of a breakdown.

PERMISSIBLE CURRENT LOADING OF CABLES.

Discussion at Manchester.

Messrs. S. W. Melsom's and E. Fawssett's second report on the heating of buried cables (an abstract of which appeared in our issue of March 9th, 1923) was reviewed by Mr. Fawssett at the North-Western Centre of the Institution of Electrical Engineers on March 20th, Mr. A. S. Barnard presiding.

Mr. H. A. Ratcliff described the report as being full of matter of immense value, but he was a little disappointed. His criticism of the preliminary report two years ago was still more or less applicable to the present report. They would get ahead much faster and time would be saved if they started with the h.p. cable and worked backwards on the principle of the greater towards the l.p. cable. In many cases the maximum safe temperature would never be attained, and they would never work up to the point when they reached it. No attempt had been made in the report to define that temperature. The Manchester 33,000-volt cable loadings (maximum temperature of 60 deg. C.) were very little different from many of the figures given in the paper, having regard to the fact that they tried to ignore the resistivity of the ground. For instance, on a 0.1 cable their loading was 165 amperes; 0.15, 210; 0.25, 280; 0.3, 315; 0.35, 345. One remarkable fact was that when cables were drawn into ducts the resistance of the ground was more or less immaterial. That 15 deg. difference he did not like, and it was really serious; it meant a difference of 12 per cent. in the loading of the cable. Could the reduction of temperature rise be omitted if cables instead of being lead-covered were wire-armoured? The most important feature of the paper was the information relating to the short-time ratings, because, as a rule, it was only under emergency conditions that cables were drastically overloaded. Dielectric losses were rather a bogey at the moment, and contraction and expansion were not so serious as was imagined; a very large proportion of the troubles due to contraction and expansion was more or less the result of bad joints. The simplest joint for a three-core cable was perhaps the plain sleeve joint; it was strong enough for all practical purposes, provided that the sleeves were fitted with grub screws which in themselves did not add materially to the strength of the joint, but held the conductors. There is a great deal of information in the report relating to ground iso-thermals, temperature gradients, and so on, but it related more or less to virgin ground. To what extent would those curves and formulæ apply in a city where there was a miscellaneous collection of gas and water pipes, &c.? That three-core cables had the same temperature rise when heated by either direct or alternating current did not seem to be quite in accordance with the accepted figures on the subject; usually about 5 per cent. additional loss was taken as being caused by eddies in the lead sheath.

Mr. W. J. Medlyn asked whether there was some relation between telephone and power cables. When the ground was not level the tendency was for the cables to slip downhill when they expanded, but when they contracted they did not climb back again; the result was very heavy strains at one section of the cable. Telephone cables had a tendency to creep along through the ducts, sometimes even when there was very little difference in level, and the joint jammed in the end of the duct and the lead sheath was fractured.

Mr. A. B. Mallinson said that it was only natural to assume that different makers sometimes had different insulation, and that would have an effect upon the figures given in this report. People did not often realise that in many cases a cable trench would for years act as a drain for the surrounding country.

Mr. Porter pointed out that single-way ducts were more general than multi-way ducts, in which case there was a much wider space between the ducts.

Mr. E. Fawssett, in reply, said that dielectric losses were going to be a bigger thing than the rest of the things combined. He agreed that they were a bogey up to a certain pressure, and that was why loading tables were not got out for cables of over 11,000 V. At a temperature of 65 deg. C. dielectric losses with h.p. cables were going to be a very serious matter. They did not feel justified in withholding from the public all this work in order to include h.p. cables. That a three-core cable gave the same temperature rise with a.c. and d.c. had been checked at commercial frequencies both at Newcastle and at Teddington, and was substantially true. The losses in the sheath had very little effect on the core temperature. In single-core cables the matter did become extremely important; he knew of large single-core cables in which the elevation of temperature between core and sheath was only 10 deg. C. Cables laid solid would be dealt with in the next report; they were not substantially different from cables laid direct, being slightly worse.

Discussion at Newcastle.

Messrs. S. W. Melsom and E. Fawssett presented their report at the North-Eastern Centre of the Institution of Electrical Engineers on March 12th. Mr. F. G. C. Baldwin presided.

Mr. P. F. Allan opened the short discussion, and said that in general the arguments appeared to be sound, and he was in agreement with most of the assumptions made. It must be realised, however, that to make the figures of value, cable-makers would have to be asked to guarantee the thermal resistance of their cables or the thermal resistivity of the insulating materials. This might shut out some foreign competition of a harmful character. Regarding temperature rise, Mr. Fawssett had mentioned 35 deg.; he saw no reason for its adoption, and he did not agree with the duct figure which limited the rise to 35 deg. The loading of cables in mines had received less attention, and it needed to be gone into thoroughly, then those tables of figures would be of great use. One fact that impressed one was the great responsibility of the engineer in allowing proper values to all the varying constants; he could not excuse himself on the ground that he had not the information; but must use his brains in applying it. The Australian figures were not a great deal higher than the others, and he drew attention to the fact that they represented very small parts of the country mentioned, and that the cable maker or supplier who accepted those statements in good faith and used them as a basis for a cable supplied to a mining plant on a high inland plateau, might have an unwelcome and alarming surprise.

Mr. R. W. Gregory said that the ultimate permissive rise of temperature of 65 deg. was a somewhat conservative figure, when they remembered the greater rise in other apparatus. The figures given as to emergency loading and expansion were very useful. In the case of a cable entering a sub-station it often passed through a short duct and then entered open

air, and it was the length of cable in the air that settled the loading of the whole.

Mr. R. D. Spurr said it seemed regrettable that more use had not been made of old cables, the life history of which would have been most valuable. The authors' paper showed that more cables than were really necessary had been used—at least larger cables had been put in than were necessary, and this meant that capital was running to waste. In many cases those at the head of affairs did not appreciate those things. The information was available, but was not always disseminated in the proper quarters.

Mr. C. Turnbull said that cables should be run more scientifically in future than they had been, and that more attention should be paid to the ground in which they were laid. With regard to ducts, he had had some experience of the creeping mentioned. The cables required careful suspension for they contracted and expanded so often that the cable was eventually cut through were it chafed.

THE GENERATION OF ELECTRICITY IN GREAT BRITAIN.

Fuel Consumption and Units Generated during 1921-22.

In preparing the analyses and summaries of fuel consumption and units generated during the year ended March 31st, 1922, which have just been issued, the Electricity Commissioners have given effect to a number of suggestions for increasing the utility of the compilation which were received as a result of the issue of the return for the previous year. In lieu of the coal transport reorganisation scheme of areas, the present return is based primarily upon the areas of the electricity districts provisionally or finally determined. The remaining portions of Great Britain not at present included in any electricity district have been grouped in appropriate areas for the purposes of this compilation only.

Further, the grouping of generating stations in sizes based upon the number of units generated at each during the year has been considerably extended, the present return containing 13 groups as compared with four in the previous one; and the analyses have been further sub-divided to deal separately with steam stations, gas producer stations, oil engine stations, and other stations.

Following the procedure adopted by the Commissioners last year, stations have been placed in their respective groups and areas on the basis of thermal efficiency, subject to certain exceptions.

In the case of "composite" stations employing prime movers of different kinds, each such station has been classified in accordance with the type of prime mover by which the major portion of the total units were generated, and the total fuel consumption at such stations converted into the equivalent value of the class of fuel consumed by the principal prime mover. Sixteen stations were only in operation during a portion of the year, and there are 24 "composite" stations for which an overall thermal efficiency could not be calculated; these 40 stations have not been placed in their respective groups or areas, and similar observations apply to 28 other stations where no thermal efficiencies have been calculated owing to the output being entirely generated from waste heat, refuse destructors, water power, &c.

A table is given containing a comprehensive summary of the best results as regards fuel consumption per unit generated and also overall thermal efficiency for each class of station not only in respect of its own area and group but also in relation to the stations in other areas and groups, and a summary of "area" results is given which shows the total units generated, the classes of station, the fuel consumption, &c., in each area.

Only two steam power stations had an output exceeding 200,000,000 kWh, their combined output being 459,153,708 kWh, and their average fuel consumption 2.10 lb. per kWh generated; the lowest fuel consumption in this class was 1.74 lb., and the best thermal efficiency 17.2 per cent., a figure not attained by any other steam or gas driven station. Seven stations had outputs between 100 and 200 million kWh, with an average consumption of 2.41 lb., best result 1.98 lb., and best thermal efficiency 15.25 per cent., but the ten stations between 50 and 100 million kWh output, with an average consumption of 2.8 lb., include a station with the lowest fuel consumption of all—1.70 lb.—the highest thermal efficiency in this class being 16.50 per cent.

The 396 steam stations tabulated had a total output of 4,732,824,434 kWh for the year, and consumed 6,577,587 tons of fuel, at an average of 3.11 lb. per kWh; the average increases gradually from 2.10 in the largest stations to 8.58 lb. in the class 250,000-500,000 kWh, but then jumps up to 12.8 (100,000-250,000) and 20.9 (50,000-100,000), the highest thermal efficiency in this class being 4.10 per cent. and the best fuel record 6.80 lb. It is surprising to note, however, in the lowest class of all (under 50,000 kWh), comprising nine stations with an aggregate output of 217,010 kWh, that the average consumption was only 10.33 lb. and the best result as low as 4.44 lb., though the highest thermal efficiency was only 6.07 per cent.

"Gas producer" stations do not offer remarkable figures, the two largest having an aggregate output of 3,599,590 kWh generated; average consumption 1.74 lb., lowest 1.67 lb.; best thermal efficiency 15.12 per cent. The next class (500,000-1,000,000 kWh) comprising four stations shows a poor result—3.35 lb. average consumption, 2.33 lb. best, 11.25 per cent. highest thermal efficiency. All the other classes beat these figures, except the six stations under 50,000 kWh (4.06 lb. average, 3.30 lb. lowest consumption, 7.95 per cent. thermal efficiency). The 60 gas stations have an aggregate output of nearly 15 million kWh generated, with an average consumption of 2.64 lb.

Oil engine stations include two of 2,500,000 to 5,000,000 kWh, consuming 3.16 lb. of oil (18,000 B.th.u. per lb.) average, 2.79 lb. lowest, with the very low best thermal efficiency of 8.56 per cent. The next four classes (100,000-2,500,000 kWh) are very much alike, the average fuel consumption ranging between 1.65 and 1.90 lb., the lowest between 0.65 and 0.69, and the thermal efficiency between 27.45 and 29.15 per cent. The small stations (5, total output 130,179 kWh) gave 1.83 lb. average, 1.54 lb. lowest, and 12.29 per cent. Altogether there are 52 oil-engine stations, with a total output of 31¼ million kWh, at an average consumption of 2.06 lb. per kWh.

There remain 79 stations generating by waste heat, refuse destruction, town gas and water power, with an aggregate output of 105,337,820 kWh generated; 51 of these, however, being "composite," are included in the foregoing summaries. The waste heat stations, numbering 17 (7 composite), produced 54½ million kWh; destructor stations, 30 (27 composite), 17¾ millions; town's gas stations, 10 (2 composite), 3¼ millions; water power, 22 (15 composite), 29 millions. The largest water power station had an output of 18¾ million kWh generated. It is interesting to note that "waste" heat accounted for more energy than all the rest in this group; but the matter is greatly complicated by the "composite" nature of the majority of these stations.

A comparative table is given showing the best results at stations of each size and class in all the areas. From this it appears that the highest thermal efficiency is obtained with steam in Area No. 16 (North-East Coast), gas in Area No. 1 (Lower Severn), and oil in Area No. 18 (Cambridge, Huntingdon, Norfolk and Suffolk, &c.). Another table gives the kWh generated and fuel consumed in each area, by far the largest output being produced, of course, in No. 7 Area (London and Home Counties), namely, 1,382,462,122 kWh; No. 16 Area following with 692,658,577, and No. 3 Area (S.E. Lancashire) with 536,232,207 kWh.

Copies of the complete report can be obtained on application to the Secretary, Electricity Commission, Gwydyr House, Whitehall, S.W.1, price 1s. post free.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The E.I.T.A. and the Broadcast Wireless Scheme.

My attention has only to-day been called to Mr. Falshaw's letter, which appeared in your issue of March 30th, or I should have asked your permission to reply last week.

I am sorry if your correspondent found it difficult to understand the meaning of my letter, which I thought was sufficiently plain. As, however, he singles out for attack my supposed anxiety as to imports, I may reassure him by saying that the representations that my Association has made to the Postmaster-General (in which it has received the entire support of the British Radio Manufacturers' and Traders' Association) have been dealing with very much bigger questions than your correspondent seems to have in mind, *viz.*, the monopolistic character of the B.B.C.; the generally oppressive character of the B.B.C. agreement; and the whole question of the present complicated method of endeavouring to raise revenue—a method which apparently has not been very successful.

We have *incidentally* dealt with the question of imports, as it quite naturally arises in the course of an examination of the B.B.C. agreement. Perhaps you will allow me to quote the actual terms of our Memorandum to Sir Wm. Joynson-Hicks on this particular point:—

"Parliament has never sanctioned an embargo on these imports, except in so far as certain parts may be dutiable under the present Key Industries Schedule of the Safeguarding of Industries Act (Part I), *e.g.*, wireless valves.

"The effect of the present wireless broadcasting licence is to attempt an import embargo by the indirect method of departmental administration. In connection with an industry of this kind, it is submitted that this is bad. Parliament not having closed the ports to these goods, there is nothing to prevent them coming into the country, and facilities to import will be exploited by the pirate in the trade who stops outside the B.B.C. and 'takes his risk.' The man who is penalised is the established importer or importing manufac-

turer (for many large manufacturers—not excepting the 'Big Six'—have been considerable importers of certain component parts) because he cannot take the risk of ordering forward goods however badly they are needed, if they may be left on his hands. Also the public loses the benefit of improved service which it might derive from the use of improved parts available from abroad from time to time.

"The whole burden of this import embargo falls upon the listener-in, who alone is required to pay the royalties and who alone is restricted from using foreign-made apparatus or parts. The amateur or experimenter is under no such restriction. This is clearly unfair.

"At the present moment it is a very great grievance in the trade at large that the whole position is so *obscure*.

"The company, for example, is attempting, in certain instances, to fix a royalty payable in respect of imported apparatus (specially permitted to be used under the Postmaster-General's statement made in the House of Commons on July 18th last year) upon the relation between the cost price of such apparatus in the country of origin and the cost price of similar apparatus in the United Kingdom. Such difference of price where it exists has no reference whatever to the cost of maintaining a broadcasting service for the users of such apparatus. It seems extraordinary that the company should be allowed in this way to fix an 'adjustable' tariff and collect it as revenue in exchange for the right to stamp the foreign goods 'B.B.C.'

"The deputation strongly urges upon the Postmaster-General *that restrictions should, as far as possible, be lifted from the industry which is endeavouring to meet the public demand, and that if a case exists for protection (either against depreciated currency imports or foreign dumping), it should be sought under the machinery provided by Parliament in the Safeguarding of Industries Act (Part II.).*"

To avoid misunderstanding, perhaps I may add that my Association is by no means composed solely of "foreign importers." The majority of its members are British manufacturers. Some of them are important electrical contractors. All of them know only too well the danger attending the arbitrary closing-up of sources of supply of raw materials, &c.

Frank W. Challis.
Secretary, E.I.T.A.

London, *April 10th*, 1923.

Radio Demonstrations by Unskilled Operators.

Would you, through the medium of your correspondence columns, allow me to ask whether the wireless set manufacturers are aware of the extensive harm which is being done in places to the wireless trade by so-called "demonstrations" by novices who call themselves "wireless dealers." In this district, a week or so ago, the first "wireless" concert was held in a local hall, and the loan of a set was given by a "wireless dealer," who himself attended to operate the instrument (no doubt the first he had seen), with ghastly results. When once a station was picked up no further attempt at tuning was made. Music (?) came in an awful note, and spark stations galore, although in the set in use (four valves, 1 h.f., 1 dec., 2 l.f.) these faults could easily have been remedied. The result of the "concert" was a general ridicule of "wireless," and people who were on the verge, as it might be termed, of purchasing a set, soon announced that they would rather hear a gramophone.

The aerial, for instance, was not 20 yards from, and in parallel with, a trunk telephone line, while it was not 20 ft. high—absolutely ridiculous if the best results are required. While this sort of thing is allowed, I am afraid it would be a bad job for anyone owning a set if these "experts" were let loose with a regenerative installation.

Listening-in.

April 7th, 1923.

The Illumination of Automobile Showrooms.

I am an electrician employed by a large firm of automobile engineers with extensive showrooms. Perhaps some of your readers could enlighten me regarding the illumination of automobiles with highly polished bodies. The difficulty I have experienced with various methods is that, if a direct ray is on the car, say, from a 300 or 600-watt lamp at a height or distance from the car of 10 ft. to 15 ft., or even further, the polish on the car body reflects, as is only natural, and so prevents one from examining it closely. Another way I have tried is: I had a frame made with the car inside and scenery at the back of the car to resemble a picture as nearly as possible. On the top and bottom of the frame, out of sight of the public I fixed battens, each fitted with five 60-watt m.f.-lamps, the lamps being shaded to reflect the light on the body. I also was desirous of illuminating the interior, so screwed two batten holders on the floor of the body and put in two half-watt 100-watt lamps. When the lamps were switched on the interior of the car was shown off in fine style, but on switching on the battens at the top and bottom of the frame the interior lighting was immediately ineffective, at the same time causing a blending effect on the eye from the the glass on the door and sides of the body of the car. To remedy this I took out the half-watt lamps and put in automobile lamps in series around the top of the interior, but could not obtain the desired result. I have tried direct and indirect lighting, but cannot subdue the rays of the polished body of the car. What I want is to show the finer points of the car and also the interior, so as to command attention in an open show, with no glass windows. A photograph of the car in the frame will be sent if my explanation is not quite clear. The photograph clearly indicates the outside appearance of the car, and also shows the reflected rays, which are injurious to the eyes, but although the interior was illuminated at the time when the photograph was taken, it remains invisible.

Automobile Electrician.

Southampton, *April 7th*, 1923.

Arc Welding.

In answer to Mr. T. W. J. Powell, in your issue of the 2nd ult., I quite agree that the a.c. arc is an example of "continuous conduction," but not "unidirectional."

I have heard of, and seen oscillograms of, a case where welding was done on copper with a carbon electrode (if my memory is correct) in which, by careful adjustment, one half-wave was entirely suppressed; but out of many oscillograms that I have taken of welding with an iron electrode on iron, *i.e.*, ferrous material, I have never had a sufficient difference between the positive and negative portions of the wave, to be called even approximately "unidirectional."

I agree as to "continuity" being maintained by the "residual vapour"; that is what I said in my original notes.

Re power factor: In my letter in your issue of February 9th I said: "The *wattless current* associated with a.c. welding" was due to the regulating devices.

I don't understand Mr. Gilbert at all; I have used any amount of carbon electrodes with a.c., and, moreover, a.c. arc lamps are a commercial article. The objection to using carbon when welding ferrous material is that it gives a very hard and brittle deposit.

Respecting Mr. Powell's observations on high-voltage peaks, I can only say I have never found anything approaching these magnitudes; even 1,000 volts would be of the order of thirty times the normal maximum voltage across the arc, and, say, ten times the impressed voltage on the whole circuit. I ask it with all deference, but is Mr. Powell sure he is not referring to observations of current?

One could imagine short rises of current of such considerable magnitude, due, possibly, to capacity, but volts would have to be generated somewhere in the circuit, and it is difficult to see where, in an ordinary a.c welding circuit, volts of *many times* the impressed voltage could be generated.

I notice Mr. Powell says: "Secondly, due to the *lower* resistance of the residual vapour." Surely the residual vapour offers a higher resistance than the full arc, the resistance of the arc increases as the volts decrease. The objection to carbon is metallurgical, otherwise I agree, it is very nice to handle.

W. Langdon-Davies.

London, *April 3rd*, 1923.

Equivalent Temperature Tests.

Will you permit me to correct a small error which has crept into the report of my contribution to the discussion on Dr. Kahn's paper, "Equivalent Temperature Tests of the Various Types of Electrical Machinery," as appearing in your issued dated March 30th, p. 511? The symbols for rotor current at short circuit, and at full load, should read I_2s and I_2L respectively, not 12s and 12L as stated.

J. H. R. Nixon.
(Not J. G. as reported.)

Loughborough, *April 5th*, 1923.

Cost of Living in Nigeria.

Could any reader give me information regarding the climate and present cost of living in Nigeria?

West African.

Electricity Reduces Fires.—The experience of Denver (Colorado) runs contrary to the Press reporter's idea that electricity is a frequent cause of fire. According to the *Electrical World* the chief of the Fire Department of the city reports that in the last five years the number of fires has fallen by 95 per cent. This result is attributed to the rapid growth of the use of electricity for lighting, heating and power. It is further stated that not one fire in a thousand is caused by electricity. Such electrical fires as have happened have been due to defective apparatus in only a very small degree, the principal causes having been natural ones—lightning, falling trees, &c.—and, in a few cases, carelessness in the use of apparatus. Twenty-four fires, occurring in Denver during a period of two years, attributed to electricity, were shown to be due to other causes entirely.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Small Trolley Locomotive.

Fig. 1 is an illustration of a small trolley locomotive supplied to an Indian customer by British Electric Vehicles, Ltd., Churchtown Works, Southport. This consists of a motor, controller and trolley standards and arms, mounted on a four-wheeled chassis, the whole weighing about three tons. The frame is of heavy-section cast-iron, securely bolted together, and is so arranged that the centre of gravity is low, making derailment almost impossible. The axles are of 3 per cent. nickel steel, heat treated and amply proportioned, running on double-row ball bearings, two bearings to each end of the axles. The wheels are removable without special appliances, which facilitates the exchange of bearings. The tread of the wheels is chilled and under ordinary conditions should give a run of 20,000 miles. Brakes are applied to all four wheels by hand, the shoes being compensated and covered with special

Fig. 1.—A Small Trolley Locomotive.

brake lining. The motor is of the firm's own design; it is series wound with a double field, so that series-parallel control is obtained, resistance being used on the first stop only. Three speeds are provided in either direction. The drive from the motor is by spur gear, through countershafts to the axles; all running parts are mounted on ball bearings. The locomotive is fitted with double-trolley arms to save the expense of rail loading, which is difficult on contracting or excavating work, where the rails are often moved. The motors can be wound for any voltage, that supplied with the locomotive illustrated being for 440 V. d.c.

In addition to this type of tractor the firm also makes battery locomotives. This form is being employed by the "Underground" Railway Companies and the L.C.C.

Emergency Motor Stopping Devices.

Home Office Regulations provide that where machinery is driven by an electric motor means must be available of either stopping the motor or the machinery quickly to avert danger. Many "emergency stop" buttons are designed to short-circuit the no-volt release coil of the starting switch, but in cases where they are situated at some distance from the motor the resistance of the connecting wires may be so great as to defeat their object. Even if the wires are short, a dirty contact in the push-button may easily make the short circuit ineffective. To be always positive in its action, the stop-button should actually break the no-volt magnet coil circuit and not merely short-circuit it. The reason why the short-circuiting method has been so generally adopted is that it is desirable to place the no-volt magnet coil in series with the shunt field coils of the motor, and it has not been obvious how the magnet circuit could be broken without rupturing the field circuit and thereby risking great damage to the motor.

This is avoided by the distant stop push-button made by the Igranic Electric Co., Ltd., 147, Queen Victoria Street, E.C.4. This push-button has two sets of contacts—one set normally closed and the other set normally open. The closed contacts place the no-volt magnet coil in series with the shunt field. The open contacts, if closed, would provide a path for the field current independently of the no-volt magnet coil. When the button is pressed to stop the motor, it first closes the normally-open contacts, thereby providing an independent path for the field current, and then opens the

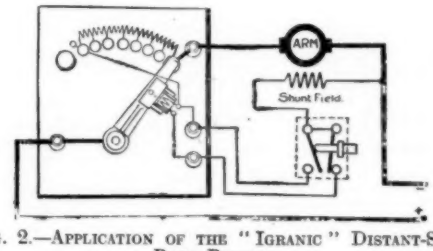


Fig. 2.—Application of the "Igranic" Distant-Stop Push Button.

normally-closed contacts, thus breaking the circuit of the no-volt magnet coil. The diagram, fig. 2, shows the application of this button to a shunt-wound motor.

The complement to the distant-stop push button is the "Igranic" "M" type magnetic brake illustrated in fig. 3, for in cases where it is necessary to bring heavy machinery to

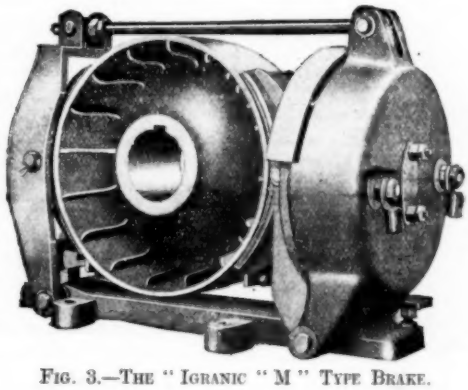


Fig. 3.—The "Igranic" "M" Type Brake.

rest practically instantaneously, to avoid serious accidents, it is not sufficient simply to disconnect the motor from the supply, because the rotating parts may continue to run for a considerable time before finally coming to rest. In such cases a brake is necessary which will be applied automatically simultaneously with the opening of the motor circuit and as automatically released when the motor is switched on. The "Igranic" "M" type brake does this if connected in series with the motor, and it is a very powerful brake. Moreover, it is very simple and robust in construction, consisting of very few parts, and it occupies very little space, which makes it applicable in practically any installation.

The "National" Water Gauge Illuminant.

The value of a water gauge as a safeguard against shortage of boiler water is often largely discounted by the difficulty of seeing where the water level actually is. With many boilers of the water-tube type this is in part due to the fact that the gauges are placed at a considerable height above the floor. To overcome this difficulty the National Boiler & General Insurance Co., Ltd., National Buildings, St. Mary's Parsonage, Manchester, has designed a fitting which lights up the gauge glass in such a way as to cause the water column to glow, thus preventing mis-reading of the levels. The device merely consists of a tubular lamp suitably mounted at the rear of the water column.

NEW PATENTS APPLIED FOR, 1923.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Patent Agents, 285, High Holborn, London, W.C. 1.

8,466. "Low-voltage electric lamp and torch battery protector." J. E. Chaney. March 26th.
8,468. "Contact means for potentiometers, &c." C. D. Aston and E. D. Gledall. March 26th.
8,491. "Electric welding machines." British Insulated & Helsby Cables, Ltd., S. C. Bullock and L. B. Wilson. March 26th.
8,492. "Electric welding machines." British Insulated & Helsby Cables, Ltd., S. C. Bullock and L. B. Wilson. March 26th.
8,499. "Illuminating devices for billiard tables, &c." E. T. Fiford. March 26th.
8,512. "Crystal detectors." C. Cox. March 26th.
8,535. "Electro-mechanical sound-transmitting and reproducing devices." B. J. Lynes. March 26th.
8,536. "Electric kinematograph projector." A. J. Easton. March 26th.
8,540. "Electric dynamos." W. S. Dennett. March 26th.
8,541. "Brushes for dynamo-electric machines." F. J. H. Phillips. March 26th.
8,574. "Magnetic power-transmission device." E. O. Burn. March 26th.
8,584. "Control of vehicles with electrical transmission." Tilling-Stevens Motors, Ltd., and H. K. Whitehorn. March 26th.
8,585. "Electrical braking of vehicles." Tilling-Stevens Motors, Ltd., and H. K. Whitehorn. March 26th.
8,586. "Thermally-actuated electric switch." C. French. March 26th.
8,593. "Wireless apparatus." Burndept, Ltd., and C. F. Phillips. March 26th.
8,597. "Machine-switching telephone exchange system." Coventry Automatic Telephones, Ltd. (McBerty). March 26th.
8,622. "Automobile headlights, &c." R. F. Bomford. March 26th.
8,665. "Automatic cut-in and cut-out devices for battery charging." F. Whipp and Whipp & Bourne, Ltd. March 27th.
8,675. "Device for mechanically rectifying high-tension polyphase current." Lodge-Cottrell, Ltd. (formerly Lodge Fume Co., Ltd.) (Metallbank and Metallurgische Ges. Akt. Ges.). March 27th.
8,680. "Insulator for wireless lead-in." L. A. C. Ewart. March 27th.
8,688. "Inductance coil for wireless telegraphy, &c." S. A. Huss. March 27th.
8,694. "Magneto contacts or collectors." P. E. Clay and J. T. Morton. March 27th.
8,696. "Means for receiving alternating-current signals." E. Potter (F. E. Pernot). March 27th.
8,702. "Device for opening or closing electric circuits or contacts." W. H. Scott. March 27th.
8,741. "Sound-directing or amplifying horns, &c." E. A. Graham. March 27th.
8,747. "Terminal blocks for electric conductors." A. Burli. March 27th.
8,755. "Wireless aerial." H. B. Fitzjohn and J. J. Hine. March 28th.
8,758. "Wireless receiving apparatus." D. S. B. Shannon. March 28th.
8,762. "Wireless receiving sets." C. Harrison, R. C. Harrison, N. C. Harrison, and G. Norris. March 28th.
8,778. "Aerials for wireless telegraphy, &c." T. de Q. Mears. March 28th.
8,781. "Means for operating automatic electric signals." E. O. Catford. March 28th.
8,782. "Radio-receiving apparatus." J. Kynaston. March 28th.
8,798. "Wireless head 'phone supports." C. E. Jacobs. March 28th.
8,811. "Means for automatic control of electric motors, &c." L. Murphy. March 28th.
8,820. "Basket aerial for wireless reception." A. W. Vincent. March 28th.
8,825. "Crystal detector." F. Bastow and A. E. Thorne. March 28th.
8,828. "Wireless telegraphy, &c." W. J. Brown, C. R. Burch, and Metropolitan-Vickers Electrical Co., Ltd. March 28th.
8,829. "Cut-out insulators for electric circuits." J. N. Robinson. March 28th. (New Zealand, May 26th, 1922.)
8,830. "Electric relays." Westinghouse Brake and Saxby Signal Co., Ltd. March 28th. (United States, November 29th, 1922.)
8,834. "Preventing arc formation and sparking in electric switches." E. Benedetti. March 28th.
8,846. "Illuminated signs." W. J. Beville. March 28th.
8,862. "Signal boxes." Gamewell Fire Alarm Telegraph Co. March 28th. (United States, December 27th, 1922.)
8,866. "Signalling receiving systems." A. D. Cowper, Radio Press, Ltd., and J. Scott-Taggart. March 28th.
8,868. "Wireless receiving apparatus." A. D. Cowper. March 28th.
8,872. "Dynamo-electric machines." British Thomson-Houston Co., Ltd., and F. P. Whitaker. March 28th.
8,873. "Dynamo-electric machines." British Thomson-Houston Co., Ltd., and F. P. Whitaker. March 28th.
8,874. "Automatic telephone exchange systems." H. Baron (Aldendorff). March 28th.
8,875. "Phase advancers." British Thomson-Houston Co., Ltd. (General Electric Co.). March 28th.
8,880. "Manufacture of electric insulators." W. E. Windsor-Richards and Siluminite Insulator Co., Ltd. March 28th.
8,881. "Luminous electric signs." F. H. Eeles. March 28th.
8,887. "Trolley poles and standards for overhead wire systems." C. W. Merrick. March 28th.
8,898. "Thermionic valve circuits." S. H. Long. March 29th.
8,899. "Receiving continuous-wave wireless signals." S. H. Long. March 29th.
8,901. "Means for electrically-indicating and recording weighments." J. Dobson and H. Pooley & Son, Ltd. March 29th.
8,914. "Operating variable condensers, &c., for wireless telegraphy." R. V. Rawnsley. March 29th.
8,920. "Interlocking devices for electric wall plugs and sockets, &c." C. L. Arnold and C. R. Belling. March 29th.
8,965. "Refrigerating machines, &c., with electric drive." B. Bischof and C. Haccius. March 29th. (Switzerland, April 10th, 1922.)
8,966. "Regulators for electric generators and starters for electric motors, &c." C. T. A. Shearer. March 29th.
8,969. "Commutators for ignition systems of internal-combustion engines." E. F. Cavender and J. Spratley. March 29th.
8,973. "Electric drum-type controllers." Crompton & Co., Ltd., and W. F. Jones. March 29th.
8,975. "Device for operation of a circuit breaker." Maschinenfabrik Oerlikon. March 29th. (Switzerland, April 4th, 1922.)
8,985. "Rheostats." A. H. Avery, G. Kent, Ltd., and D. R. A. Pistor. March 29th.
8,990. "Electric vacuum tube apparatus." Soc. Anon. pour l'Exploitation des Procédés M. Leblanc-Vickers. March 29th. (France, April 22nd, 1922.)
8,991. "Ventilation of dynamo-electric machines." Metropolitan-Vickers Electrical Co., Ltd. March 29th. (United States, April 13th, 1922.)
8,996. "Transformers for wireless receiving sets." W. L. McPherson, C. P. Smith, and Western Electric Co., Ltd. March 29th.
8,997. "Signalling systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). March 29th.
8,998. "Telephone systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). March 29th.
9,009. "Sparking plugs." F. W. Schroeder. March 29th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1921.

24,479. "Arc lamps." F. R. Jackson (Sperry Gyroscope Co.). September 14th, 1921. (194,736.)
25,031. "Electric joints." C. J. Beaver and E. A. Claremont. September 21st, 1921. (194,742.)
30,140. "Electricity meters." Measurement, Ltd., and F. Holden. November 11th, 1921. (194,746.)
30,357. "Apparatus especially useful as relay, oscillograph, telephone automatic current, or tension regulator, and other arrangements sensitive to variations of electric tensions." F. A. Johnsen and K. Rahbek. November 14th, 1921. (Addition to 144,761.) (194,747.)
30,635. "Electric incandescent lamps." Dr. F. Skaupy. November 16th, 1921. (Convention date not granted.) (172,615.)
30,636. "Electric incandescent lamps." Dr. F. Skaupy. November 16th, 1921. (194,754.)
30,852. "Electro-metallurgy or the electro-deposition of metals." A. Waldberg. November 18th, 1921. (194,759.)
30,877. "Telephones." Siemens & Halske Akt. Ges. December 29th, 1920. (173,483.)
33,411. "Burglar or fire alarms." J. Marschall. December 12th, 1921. (194,763.)
33,424. "Dynamo-electric generators for lighting on motor vehicles and like purposes." E. B. Collingham and C. J. A. Owen. December 13th, 1921. (194,764.)
33,549. "Thermionic valve relays." E. Pollock. December 13th, 1921. (194,765.)
33,551. "Automatic metering of telephone calls." A. J. Wheeler. December 14th, 1921. (Cognate application 2,401/22.) (194,766.)
33,567. "Electric heating of tools of edge-setting and other machines." British United Shoe Machinery Co., Ltd. (United Shoe Machinery Corporation). December 14th, 1921. (194,767.)
33,730. "Electrically-heated apparatus for use in hair-waving and other purposes." A. Poincet. December 15th, 1921. (194,778.)
33,762. "Apparatus for effecting electrical measurements and tests on the principle of the Wheatstone bridge." V. Planer. December 15th, 1921. (Convention date not granted.) (194,780.)
33,796. "Miners' head and like lamps." Thor Electric Safety Lamp Co., Ltd., and J. W. Jones. December 15th, 1921. (194,781.)
33,927. "Electric immersion liquid heaters." S. Abel. December 16th, 1921. (194,789.)
34,054. "Coating of electrical conductors." W. S. Smith and A. D. Shuter. December 17th, 1921. (194,796.)
34,142. "Electric resistances and the like." H. A. Watts. December 19th, 1921. (194,799.)
34,151. "Means for the fine mechanical adjustment of electrodes such as are used in spark gaps, detectors, and the like." P. C. Rushen (Bing Werke vorm Geb., Bing Akt. Ges.). December 19th, 1921. (194,800.)
34,431. "Electro-magnetic control devices for electric arcs." F. W. le Tall (Westinghouse Electric & Manufacturing Co.). December 21st, 1921. (Convention date not granted.) (173,240.)
34,602. "Ignition magnetos for internal-combustion engines." British Lighting & Ignition Co., Ltd., E. O. Turner, and E. B. Tuppen. December 23rd, 1921. (194,822.)
34,947. "Electric driving mechanism for sound-recording or reproducing machines." P. A. Becker. December 29th, 1921. (194,831.)
35,089. "System of pole-changing for polyphase induction motors." Dr. O. T. Blathy. June 9th, 1920. (Addition to 161,973.) (173,527.)
35,098. "System of pole-changing for polyphase induction motors." Dr. O. T. Blathy. April 9th, 1921. (Addition to 161,973.) (178,411.)

1922.

202. "High-frequency telephony, telegraphy, and the like." E. Pollock. January 3rd, 1922. (194,836.)
1,150. "Apparatus for heating water by electricity." L. G. De Kermor. January 13th, 1922. (194,847.)
1,655. "System and means for electric lighting of motor road vehicles." W. T. Wilkinson and R. Tilley. January 19th, 1922. (194,854.)
1,925. "Manufacture of insulators for aerial lines." H. Wolfe, W. Slack, and G. Griffiths. January 23rd, 1922. (194,859.)
2,153. "Thermionic valve transmitting sets for wireless telegraphy and telephony." L. G. Preston and G. Shearing. January 24th, 1922. (194,864.)
2,991. "Control handles for electric devices." R. Brooks and Metropolitan-Vickers Electrical Co., Ltd. (Westinghouse Electric and Manufacturing Co. (in part)). February 1st, 1922. (194,877.)
2,993. "Selecting switch mechanism." Western Electric Co., Ltd., and G. Deakin. February 1st, 1922. (194,878.)
3,347. "Electron discharge apparatus, such as thermionic tubes." General Electric Co., Ltd., C. F. Trippe, and O. Durdle. February 4th, 1922. (194,882.)
3,377. "Thermionic tubes." C. S. Goode. February 6th, 1922. (194,883.)
3,524. "Battery carrier and container." T. McKenna (Dictograph Products Corporation). February 7th, 1922. (194,886.)
4,468. "Thermionic valves." L. G. Preston, H. C. Hughes, and S. R. Mullard. February 15th, 1922. (194,899.)
6,289. "Electric switches." J. C. White. March 3rd, 1922. (194,922.)
6,622. "Galvanic batteries." Fuller's United Electric Works, Ltd., and L. Fuller. March 7th, 1922. (194,924.)
7,422. "Head lamp for motor vehicles and the like." E. T. Sweeney. March 14th, 1922. (194,934.)
8,813. "Vibration indicators." British Thomson-Houston Co., Ltd. (General Electric Co.). March 27th, 1922. (194,945.)
8,887. "Overload circuit breakers." F. Krupp Akt. Ges. June 20th, 1921. (Addition to 175,964.) (182,091.)
9,521. "Electric gas lamps with glow discharge." Patent-Treuhand-Ges. für Electrische Glublampen. April 4th, 1921. (177,811.)
10,076. "Apparatus for starting low-powered electric motors." A. Melotte. April 8th, 1922. (194,954.)
10,598. "Method of jointing electric conductors." J. F. Schleper. April 13th, 1922. (194,956.)
10,982. "Electrically-heated flat irons." Orlentex Handlesges. September 12th, 1922. (186,029.)
11,165. "Switch apparatus for controlling the electric starting motors of internal-combustion engines." "Scintilla" (firm of). May 4th, 1921. (179,528.)
11,775. "Electrical tumbler switches." A. C. Wynne. April 27th, 1922. (194,968.)
12,971. "Multiple control apparatus for electric railways." Akt. Ges. Brown, Boveri et Cie. April 1st, 1922. (194,974.)
12,977. "Electric contact plug." M. A. Persson. May 8th, 1922. (194,975.)
13,912. "Electric switch." M. A. Persson. June 2nd, 1921. (180,997.)
14,873. "Detectors for use in wireless telegraphy and telephony." R. M. Radio, Ltd., and H. R. Rivers-Moore. May 26th, 1922. (194,983.)
14,909. "Electric water-heating apparatus." Hydrotherm Fabrik Elektrischer Apparate Ges. June 8th, 1921. (181,343.)
15,771. "Electric roasting oven." A. Thesen. June 6th, 1921. (181,360.)
19,625. "Apparatus for effecting the automatic connecting-in and disconnecting-out of electrical machine units." Akt. Ges. Brown, Boveri et Cie. September 10th, 1921. (186,034.)
19,919. "Electric lamps for kinematographic and other projection apparatus." Pathé Cinema, Anciens Etablissements Pathé Frères. December 5th, 1921. (189,743.)
21,246. "Commutating electrical machines." K. Nobuhara. August 3rd, 1922. (195,004.)